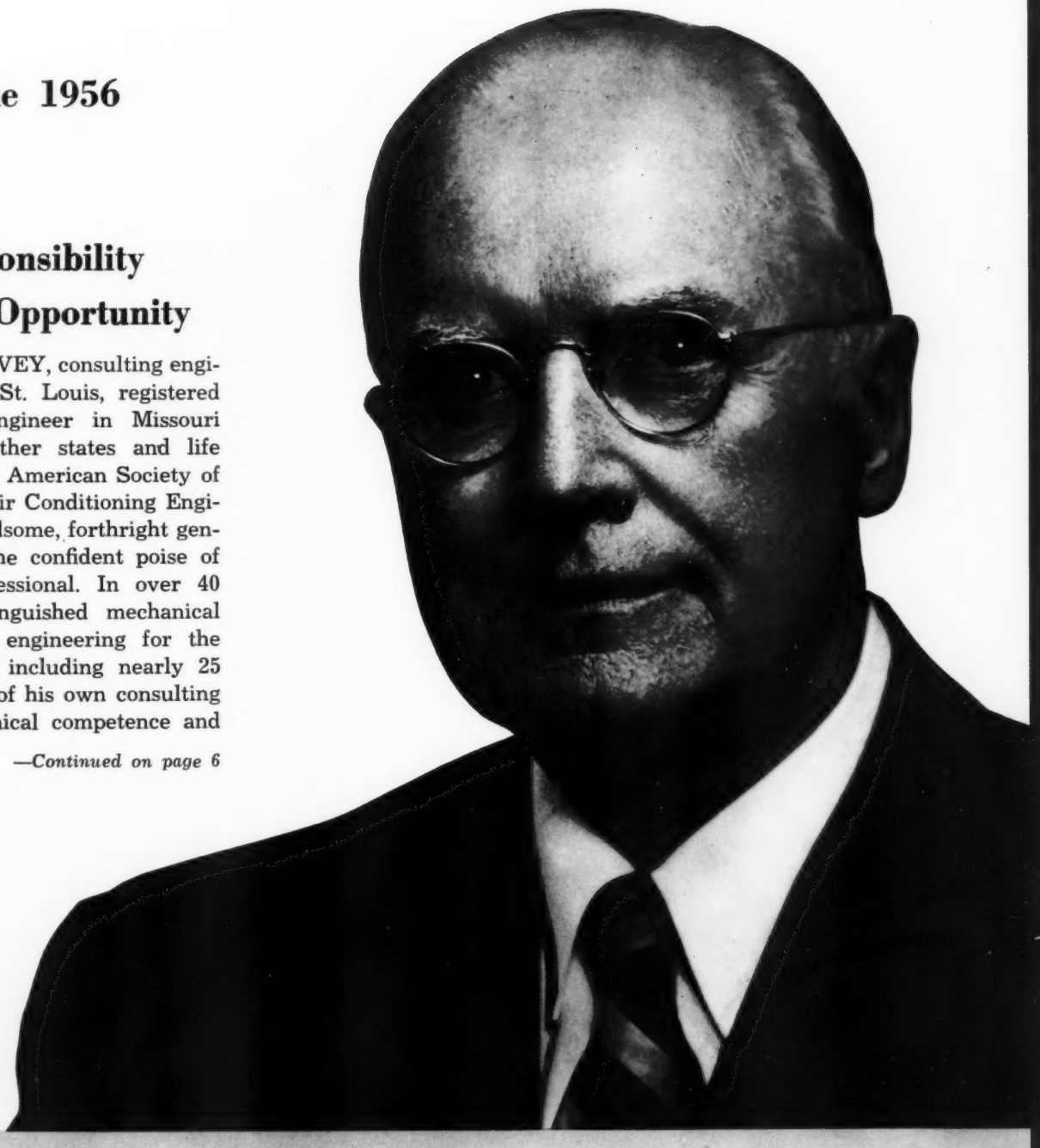
Consulting Engineer

June 1956



Responsibility Means Opportunity

JOHN D. FALVEY, consulting engineer, of St. Louis, registered professional engineer in Missouri and several other states and life member of the American Society of Heating and Air Conditioning Engineers, is a handsome, forthright gentleman with the confident poise of the true professional. In over 40 years of distinguished mechanical and electrical engineering for the building field, including nearly 25 years as head of his own consulting firm, his technical competence and

—Continued on page 6

The Consulting Engineer's Professional Magazine

This accident is obsolete

125-lb. OIC union bonnet bronze gate

But the valve is still in specs! Screwed bonnet bronze gate valves have been out of date ever since OIC introduced a complete line of *union* bonnet gates . . . *3 years ago!* Yet some old specs and some new ones still insist on the obsolete screwed design, and someone continues to pay for trouble.

OIC 125-lb., 150-lb., 200-lb. bronze gate valves all feature the safer, easier-to-maintain *union* body-bonnet joint. This line is the most complete in the industry.

Step up your valve requirements to the modern high quality standards reflected in OIC Valves. Include OIC in your next specification.

Write for Form No. 1006 which illustrates specification details of the OIC line of bronze union bonnet gates.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC VALVES

FORGED & CAST STEEL, LUBRICATED
PLUG, BRONZE & IRON VALVES

VOLUME 7 NUMBER 6

Published by
Consulting Engineer Publishing Co.
227 Wayne St., St. Joseph, Mich.

MANAGING DIRECTOR
R. W. Roe

EDITORIAL
Hunter Hughes
A. M. Steinmetz
J. C. Dean
F. E. DeWolff

ART
Len Sentowski
Jack Knuth

PUBLISHER
E. R. Gauley

BUSINESS MANAGER
F. C. Donohue

CIRCULATION
E. C. Kelm

SALES REPRESENTATIVES

New York —
Mead Irwin, Ted E. Gordon
141 East 44th St., Rm. 512
Oxford 7-9677

Philadelphia —
D. L. McKechnie, 816 Lancaster,
Villanova, La 5-4692

Cleveland —
O. D. Young, 3304 Avalon Rd.,
Shaker Heights, Wy 1-4841

St. Joseph, Mich —
J. E. Tym, 227 Wayne St.
Yukon 3-5511

Chicago —
E. R. Gauley, 360 N. Michigan,
Rm. 614, Dearborn 2-3519

Dallas, Texas —
R. E. Hoierman,
2831 El Capitan Dr., Da 7-3630

Los Angeles —
Justin Hannon, 4710 Crenshaw,
Axminister 2-9501

SALES MANAGER
O. DeWitt Young

CONSULTING ENGINEER is published monthly at 227 Wayne St., Saint Joseph, Mich. Price 1 year $10.00; foreign $15.00; single copy $1.00. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Send Form 3579 to Saint Joseph, Mich. Copyright 1956 Consulting Engineer Publishing Co.

consulting engineer®

June 1956

FEATURE ARTICLES

Specialized Field . . . Food Facilities Engineering 34
N. Bert Persson

Changes in A.C.I. Building Code Requirements 38
Paul Rogers

Electrical Distribution System Planning for Shopping Centers .42
Robert A. Zimmerman

Try Yardsticks for Cost Control 52
John J. Mahoney

How Ebasco Prepares Technical Reports 57
John R. Mayer

N.Y.A.C.E. Sets Up an "Employees Pool" 60
Samuel A. Bogen

U. S. Consultants Meet With British 67

DEPARTMENTS

Personality—John D. Falvey .....Front Cover
The Reader's Guide 10
Readers' Comment 14
Scraps and Shavings 20
Economic News Notes—*E. F. MacDonald* 24
Atoms in Action 26
The Legal Aspect—*Melvin Nord* 28
Report From Paris—*Waldo Wallis* 62
News for the Consultant 68
Men in Engineering 80
Notes From Abroad 84
New Projects Reported 90
Books 98
Meetings 104
Advertisers' Index 106

The Engineering Index Service in Public Libraries lists articles from CONSULTING ENGINEER

The Consulting Engineer's Professional Magazine

John D. Falvey

—Starts on front cover

high ethical standards have earned the respect of his contemporaries, who consider him the dean of consulting engineering in the St. Louis area. Falvey's own outlook is optimistic and enthusiastic, for he feels he has been privileged to witness an evolution that has carried engineers in the building field from relative obscurity to a current position of increasing recognition among architects, clients, and the public. He firmly believes continuing technological progress will make the engineer the dominant figure in the building field of tomorrow.

Falvey's own background amply substantiates his opinions as he has seen the building field from both the contractor's and the consultant's sides of the fence. After graduating from Washington University, in 1912, with a B. S. degree in mechanical engineering, he joined the Tait Nordmeyer Co., one of the leading firms of refrigeration engineers in the Midwest. Falvey recalls that they designed refrigerating plants, built buildings, sold compressors and other equipment, and even did work in China.

Following this assignment, Falvey became a member of the staff of a heating and piping contracting company which handled jobs all over the United States. Then after a period as Lieutenant in the Field Artillery during World War I, Falvey engaged in sales engineering for heating and ventilating equipment until starting his own consulting firm. He points out that during the 20's, contractors were a sort of Jack-of-all-trades. Contractors then employed engineers, served as designers, and were manufacturers' representatives as well as constructors. Their competition primarily was from sales engineers of manufacturers, who did complete heating layouts and performed similar engineering services.

Falvey started his own firm in 1932, during the depression, when most architects were doing their own mechanical and electrical layouts. But as Falvey philosophically explains, "I thought that if I was going to work for nothing, I might as well work for myself. We gradually built up our business volume, primarily doing mechanical and electrical engineering work for architects. This is a fascinating field — an excellent index to prosperity and one that places tremendous responsibility on the consultant. It is the engineer who makes a building habitable. Every monumental building project reverts back to the unit of the home and its basic needs. A building is useless without lighting, heating, cooling, sanitary facilities, and other related services required by the occupants, so on a building project, the successes or failures charged to the architect are really the engineer's successes or failures.

"Our first big job was the main U. S. Post Office here in St. Louis. In contrast to the scheduling that would apply today, that project kept seven men busy for a year — despite the fact that in those years the mechanical and electrical engineering participation only amounted to about 10 or 15 percent of the total cost of a building project.

"The first big increase in the engineer's responsibility in the building field occurred during World War II. Demands for war production and projects for the Armed Services called for major advances in technology, and the engineers met the challenge. We did our share of the work, even handling plants as far afield as Argentina, Belgium, and Scotland. Two of our projects, the 'Proximity Fuse' plant, in St. Louis, and the 'Naval Base,' at Lambert Field, earned us commendations from the Navy.

"Air conditioning also has had a major influence on engineering responsibility in the building field. From St. Louis south, and to an increasing extent to the north, air conditioning is coming of age. In industrial plants the costs of air conditioning often can be justified alone on the basis of cutting down absenteeism. It has also been completely sold to the public, and is now finding increasing application in homes and churches. Competition is one of the reasons for this growth. Advertising by manufacturers also has helped, as the public is much better informed and the clients more alert to popular demands.

"For the architect, air conditioning offers new freedom for creative work and clears the way for many new structural and space arrangements. Windowless buildings would be impossible without air conditioning. We have done hospital projects where the operating rooms and laboratories are completely encircled by interior corridors. In looking at the plans you could say the operating section block was a tomb, yet with air conditioning, it is possible to maintain constant temperatures, provide germ-free areas, or meet any other special requirements.

"Hospitals, incidentally, are an excellent example of engineering responsibility and of the interrelation between mechanical and electrical services. The services for therapy sections; operating rooms; and hot labs (which require coordinated supply and exhaust systems with special ducts to carry the exhaust, purified by electric heaters, to the highest possible discharge point) are all extremely complex. Similarly, lighting, call systems that function effectively at low audibility, and sometimes closed circuit color television for educational purposes are but a few of the details that pose problems.

"In the past 10 years, our biggest work volume has been on housing projects in the St. Louis area. St. Louis has an excellent program that really goes beyond slum clearance to what might be termed urban redevelopment. All of the units are complete but not extravagant. Before each new project starts, a complete study is made to determine proper room ratios based on the families who will become the occupants.

"When we did the first group of units, the conventional design had the laundries all in the basement.

Totally Protected

FROM CORE TO COVER

RELIANCE *Totally-Protected* MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

Slot cell insulation of Double Backed Mylar

Dynamically balanced rotor for vibrationless operation

Entire insulation system impervious to acids, moisture and oils

Metering plate regulates grease flow to bearing

Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details?

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 336 A, CLEVELAND 10, OHIO

Canadian Division: Welland, Ontario

Now we are doing projects with the laundries located up on skip-service floors between housing floors as our concepts continuously move toward greater convenience. Some of the units have their own boiler plants; others use district steam from the underground central heating system we have in St. Louis.

"Regardless of the type of building, the increasing complexity of the services pyramids the need for engineering. We now have a situation where the mechanical and electrical engineering represents 35 to 55 percent of a building project. By adding the cost of the work handled by the structural engineer, the combined engineering participation will range from 65 to 75 percent. The exact ratio, of course, will depend upon the type of structure, being highest in such units as air conditioned laboratories with their multiplicity of services.

"This represents a big responsibility for the consulting engineer. In the current hurly-burly of building activity, the architect may authorize the contractor to order the steel, and the excavating work may be under way before we start on the mechanical trades. On one project it may be a question of combating a space problem, frequently necessitating the use of a high velocity air conditioning system. With the new windowless buildings, there is the problem of supplying access to fight fire. Then, too, there is increasing interrelation between mechanical and electrical trades, particularly with almost all equipment performance dependent upon controls — an area, in itself, that has brought many changes in engineering.

"With this pyramiding need for competent engineering, consultants are faced with the problem of obtaining adequate help. Actually, there is a dearth of people who are qualified to do our type of work, and a ready supply of experienced personnel is not available. Young graduates do not aspire to enter consulting work, preferring to specialize. They do not want to do any drafting, even of a preliminary and sketchy type, even though in our field the viewpoint of the board is tremendously important, as someone must necessarily correlate the details between all of the various mechanical and electrical services. I believe consultants should take steps toward encouraging the engineering schools to make students conscious of the consulting field, at least by the time they reach their junior year in college. The architects already have recognized this need, perhaps because many of them feel project coordination is increasingly important to them.

"Years ago when the mechanical and electrical services were relatively simple and a circle on the plans served to indicate a vent line or stack and a rectangle marked 'rad' showed the location of radiators, the problem was not very difficult. But the current trend all over the country is to include detail — and more detail — when preparing plans and specifications, because of the multiplicity of services. Accordingly, high standards are being set. In our work we prepare separate mechanical and electrical plans, and in addition, divorce the ceiling plans from the floor plans because of the complexity of the layouts. Actually, this arrangement saves the contractor time in estimating a project and assures greater accuracy and uniformity of bids. We have found that the contractor does not want to guess at requirements, and if he must guess, he simply adds a contingency factor to cover possible extra costs. The contractor also does not want to do supplemental engineering, and should not be required to do so. The consulting engineer can accordingly avoid this with proper detailing. My own feeling is that if people say an engineer is 'detail minded,' it is the highest compliment they can pay him.

"Right now, I don't think you could even get a loan for a building project without an intelligent set of plans. This is all to the good. In the long run, the more work done by the consulting engineer, the more economical the project will be. The client pays extra when things are not shown clearly on the plans and covered properly in the specifications, and the consultant also suffers by having to spend extra time in following the construction work and in making final inspections. We avoid this by including isometric drawings of all piping and completely detailed elevations of all service areas. Contractors are thus able to order material from their original take-off.

"Engineering of this type is demanding, and not cheap, but it does serve to stifle 'free engineering' by manufacturer's representatives and also to enhance recognition of the consulting firm. We feel the trend toward increasing dependency on the consulting engineer will continue.

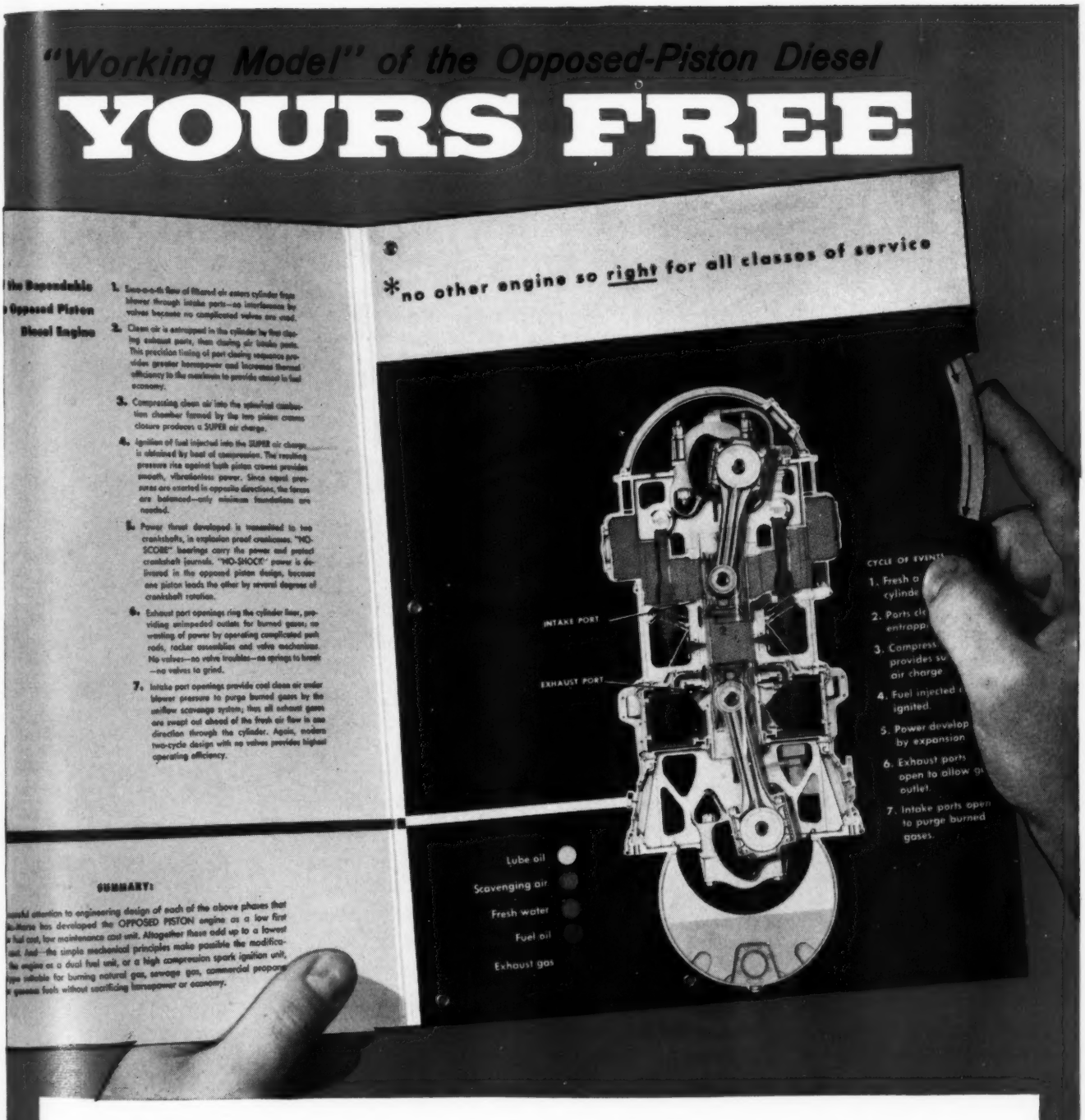
"It would appear that the building field ultimately must resolve in one of three ways; fully integrated engineering and architectural firms with construction departments; fully integrated engineering and architectural firms without construction departments; or joint ventures with both engineers and architects receiving primary contracts. I think the latter is the answer.

"There are, of course, business problems for consultants. Consulting firms must sustain an adequate uniformity of business volume, since their principals continuously have the responsibility of meeting their payrolls. This is only one of the community interests among consultants.

"Much has been said about handling such matters through Functional Groups within NSPE, but that is not the answer to consultant's business problems. I think we used the right approach when we established the Missouri Association of Consulting Engineers last year. Interest in this group is picking up tremendously, and it is apparent that a similar movement is taking place all over the country. With such help, consultants will gain added stature, and will fully realize the benefits of the opportunities that exist at the present time." ▲▲

"Working Model" of the Opposed-Piston Diesel

YOURS FREE



Here in Graphic Full Color

is a detailed working model of the Fairbanks-Morse Opposed-Piston Diesel Engine—and it's yours free for the asking.

With the 8-inch operating cutaway in front of you, you can follow the complete operating cycle of this outstandingly successful heavy-duty engine designed for continuous service. Moving the disc at the right operates the model showing exact position of pistons, and color codes condition in the cylinder, throughout the entire cycle of events.

You'll also see the simplicity of the O-P that has no valves, intricate valve trains, cylinder heads and gaskets—in fact, it has 40% fewer moving—wearing—parts than any comparable engine of equal horsepower.

If you are interested in dependable power with low operating and maintenance cost, send for your working model of the O-P diesel today! Simply attach this advertisement to your letterhead (or ask for O-P "Working Model") and send to Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

DIESEL AND DUAL FUEL ENGINES • DIESEL LOCOMOTIVES
RAIL CARS • ELECTRICAL MACHINERY • PUMPS • SCALES
HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

The Reader's Guide

A great many manufacturers of engineering equipment and construction materials seem to have discovered recently that the consulting engineer is the man who specifies their products, and they have decided that the right place to get their story before the consultant is in the pages of this magazine. Perhaps you have noted our growth. This is a good thing for you, the reader, as well as for us, for the more advertising we get, the more we can spend to bring you the kind of magazine you should have. We do not mean that we suddenly have become so flush with advertisers begging for space that we no longer need our salesmen, but conditions have improved considerably over the not too distant past, when the usual greeting from an advertising manager or an agency man was, "What's a consulting engineer?"

The Specialist

The educational process is not yet complete. We were interested in a survey that appeared recently in the editorial pages of *Chemical Engineering Progress*. One question was supposed to determine the extent to which consulting engineers are used by the chemical industry in new plant projects and expansions. Turns out consulting engineers are very little used... This is a surprising discovery — until you find that by "consulting engineer" the author means an outside engineer who has to do with "nonconstruction phases such as process design, equipment development . . .etc." This is like running a survey on the use of architects in designing new churches and finding they are not much used in that field; architects being defined in the survey as specialists in landscape gardening, interior decorating, and special lighting effects.

Shopping Centers

It is not often that we give ten pages to an article. The subject has to be one of great importance, and we have just that in the article in this issue — "Electrical Distribution Systems for Shopping Centers." Shopping centers are a big chunk of the new construction in almost every urban area, and Robert Zimmerman, the author, has made a conscientious study of the subject. A slightly expanded reprint, discussing not only electrical distribution but also methods for making load calculations for shopping centers is available to our readers for the asking.

Membership Drive

The original copy we received for the story on Julian Tritton, starting on the cover of our May issue, stated that the British Association of Consulting Engineers had 900 members. Not until after this form was off the press did we receive a correction reducing this figure to 400. If there is anything we dislike, it is inaccuracy, so our first effort while in England will be to try to get the British Association to undertake a membership drive designed to something more than double their current membership.

Word Watchers

One of our advertisers reports that he now appreciates our frequent warnings concerning choice of words when writing copy for the advertising he carries in this magazine. At the bottom of one of his ads he offered to our readers an "architects' kit" designed to assist in the writing of specifications. Shortly after the issue was published he received a personal visit from a representative of a group of consulting engineers asking him to please refer to the item as a "consulting engineers' kit" when offered in our pages.

Survey

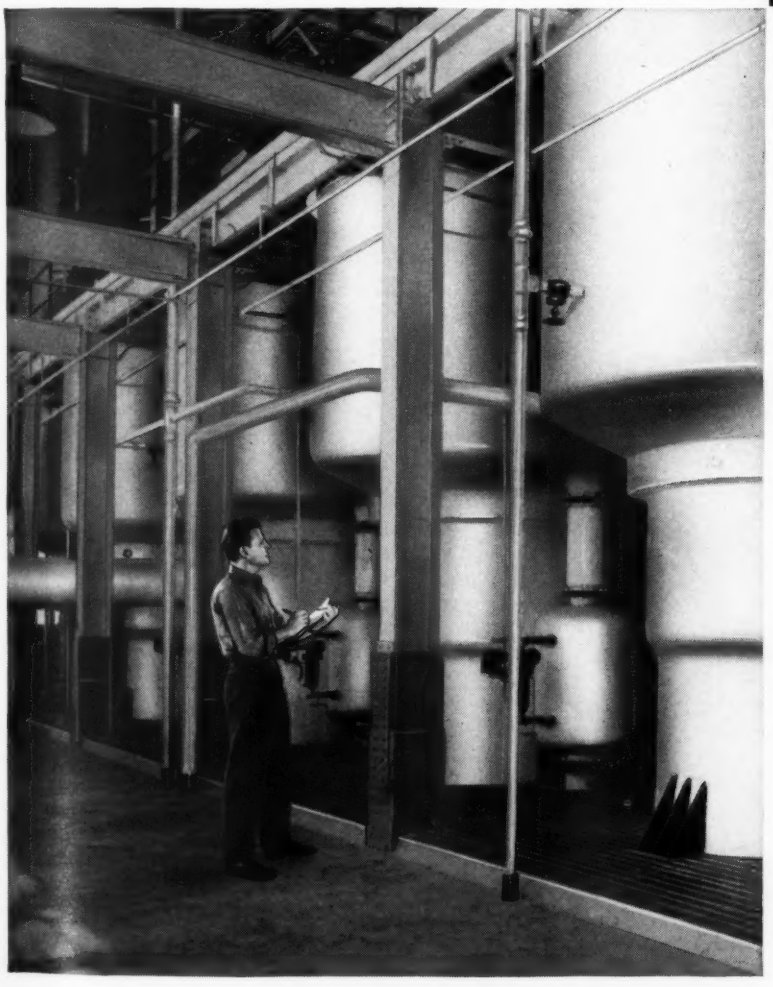
This might be a good time to run a little survey that could bring some advertisers around to an understanding of what does or does not appeal to the engineer in private practice. Send us a postcard on which you indicate the best and worst ads in this issue from the point of view of the consulting engineer. The address is 227 Wayne St., St. Joseph, Michigan.

...ANOTHER RESULT OF IMPROVED PROCESSING

SWENSON EVAPORATORS

help produce better sugar...

at lower costs



Refiners of beet sugar are experiencing new success through an improved method of processing—Swenson Multiple-Effect Evaporation. Swenson high-velocity LTV pressure evaporators are generating essentially all of the process vapors used in modern beet sugar factories. Heat economies of approximately 500,000 BTU per bag of sugar are being obtained. Food, chemical, pharmaceutical—almost every type processing industry—has profited substantially from Swenson Evaporation equipment. The reason: Swenson Evaporators can improve product quality while lowering production costs. *Your* product could be next. The surest way to find out is to talk with a Swenson engineer. Call or write today.

SWENSON EVAPORATOR CO.

15620 Lathrop Avenue, Harvey, Illinois

SWENSON

Proved Engineering for the Process Industries

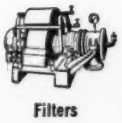
Since 1889

A Division of WHITING Corporation

Evaporators

Spray Dryers

Crystallizers



Filters

The 110'6" debutanizer shown above and the 150-ton unit (below), a 3-stage axial flow compressor, are typical Newport News products. Whether you need a hydraulic turbine, vacuum tanks or penstocks . . . bridge caissons, digesters or dryer rolls . . . you can command the services of Newport News for units of about any size or shape.

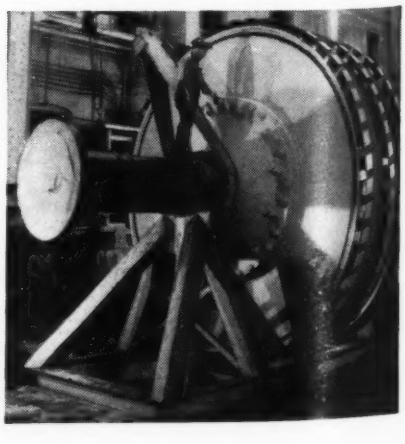
Newport News builds wide variety of large units

ALMOST ANY TYPE of heavy equipment can be built by Newport News.

And the reason? Specialized production techniques for one thing. You get the benefit of plant methods and equipment developed as a result of Newport News' seven decades of experience. Seven decades fabricating millions of tons of steel . . . carbon, corrosion-resistant alloy, clad and other special steels.

Moreover, Newport News' plant provides unsurpassed facilities. More than 225 acres in area, it comprises vast steel fabricating shops, five huge machine shops, acres of pattern shops and foundries. It includes forge and die shops, heat treating furnaces and allied equipment, along with complete modern test apparatus.

But most important of all . . . it is the high integration of skill and production facilities that enables Newport News to build large units fast . . . to save valuable time. Let us bid on your present or future projects. Write today for your copy of our illustrated booklet "Facilities and Products."

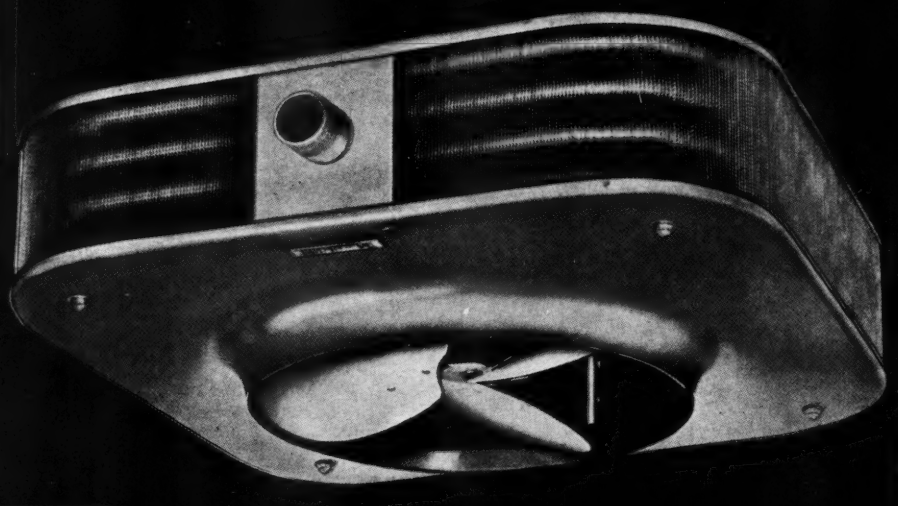


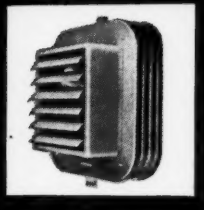
Engineers – Desirable positions available at Newport News for Designers and Engineers in many categories. Address inquiries to Employment Manager.

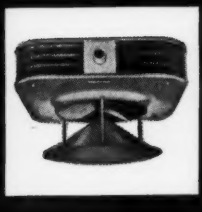
Newport News

Shipbuilding and Dry Dock Company
Newport News, Virginia

New Design . . . New Features







the all new Nesbitt Little Giant unit heaters

One heating element operates on steam or hot water in both vertical and horizontal applications. Wrap-around rectangular construction increases heat transfer area. Opposing headers mean shorter tubes and condensate travel, assuring more even heating on steam systems.

Closer-to-ceiling mounting permitted by side-located piping connections. Motor on all models is removable through botton fan outlet, eliminating the need for access space above the unit. Maximum headroom is assured.

Wide variety of outlets (Adjustable Vane, Cone Deflector, Anemostats and Horizontal- or Vertical-Louvred) simplifies selection of the discharge patterns and mounting heights best suited to the job requirements.

Larger capacity range (34,000 to 684,000 Btu per hour) and smaller physical size permit the economical use of these "propeller fan unit heaters with blower fan performance" in all types of industrial and commercial buildings.

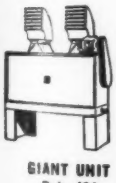
IUHA Rated for Sound and Capacity. All 34 models are sound rated according to today's most reliable basis for judging sound emission. You may now select Little Giants sound coded for the environment they serve.

Little Giant Unit Heaters are tested and rated in accordance with the Standard Test Codes adopted jointly by the Industrial Unit Heater Association and the American Society of Heating and Air Conditioning Engineers.

IUHA MEMBER — HEAT WITH UNIT HEATERS — ADVANCE THE HEATING ART — INDUSTRIAL UNIT HEATER ASSOCIATION

Send today for Nesbitt Publication 402.

Other Nesbitt Unit Heaters



GIANT UNIT
Pub. 404

PROPELLER FAN
Pub. 401

GAS-FIRED
Pub. 280

SERIES C
Pub. 403

Nesbitt Unit Heaters are made and sold by
John J. Nesbitt, Inc., Philadelphia 36, Pa.

Nesbitt
LITTLE GIANT UNIT HEATERS

READERS' COMMENT

National Federation of CE's

Sir:

I think you will be interested to learn that as of this date the following associations of consulting engineers have signified their acceptance and wish to ratify the draft Constitution and By-laws of the proposed National Federation of Associations of Consulting Engineers:

Consulting Engineers Association of Oklahoma
Minnesota Association of Consulting Engineers
Consulting Engineers Association of California
New York Association of Consulting Engineers
The Association of Consulting Engineers of Upstate New York
Missouri Association of Consulting Engineers

Certain of these associations have suggested changes but these are minor in nature and do not affect the over-all concept of the draft.

. . . the Interim Steering Committee has now officially written to the Consulting Engineers Association of Oklahoma requesting that they act as hosts and set up the July 6th, 7th, and 8th meeting in Tulsa.

John K. M. Pryke, President,
New York Association of
Consulting Engineers
and Chairman of Interim
Steering Committee for
Proposed N.F.A.C.E.

Sir:

. . . if any new state associations are in the process of forming an independent association of consulting engineers, and hope to attend the Tulsa meeting, they should write to me for copies of the proposed national federation Constitution and By-laws so that their constitutions will conform to the membership requirements, thereby being assured that they will be approved by the National Credentials Committee.

. . . those individuals that are interested in forming an independent association of consulting engineers in their state are welcome to attend the Tulsa meeting where we are sure they will receive plenty of suggestions and encouragement and will have all their questions answered.

T. E. Roche, Chairman
Extension Committee,
Minnesota Association of
Consulting Engineers
517 Sexton Bldg.
Minneapolis, Minn.

• SEE P. 72 THIS ISSUE FOR INFORMATION ON THE N.F.A.C.E. MEETING IN TULSA, OKLA.

Engineers' Salaries

Sir:

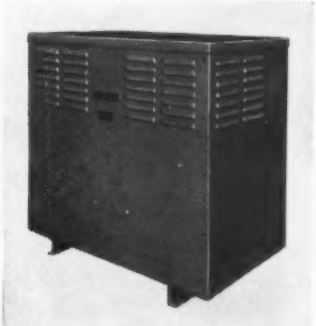
In the May 1956 issue of CONSULTING ENGINEER, there was an article entitled "Consultants Can Hire the Men They Need," by one of your staff reporters.

In this article, there were some interesting figures on salary ranges for engineers at various age and experience levels.

I should appreciate it very much if you could let me know the source of these data.

Carl E. Miller
New York, N.Y.

Single-Phase Transformer, with circuit breaker*, for power and lighting loads. Sizes from 5 to 1000 KVA. *Optional



Insulating Transformer for three-phase operation, 480 volt primary; 120/208 volt secondary, 60 cycles. Sizes from 6 to 2000 KVA.

HEVI-DUTY SINGLE AND THREE-PHASE INSULATING TRANSFORMERS ARE . . .

COOL — Have highly efficient chimney-type ventilation system.

QUIET — Special core and coil design greatly reduces transformer hum.

CONVENIENT — Top cover is removable for easy access to leads.

DURABLE — Rigidly blocked coils are vacuum-impregnated with special varnish to insure long trouble-free operation.

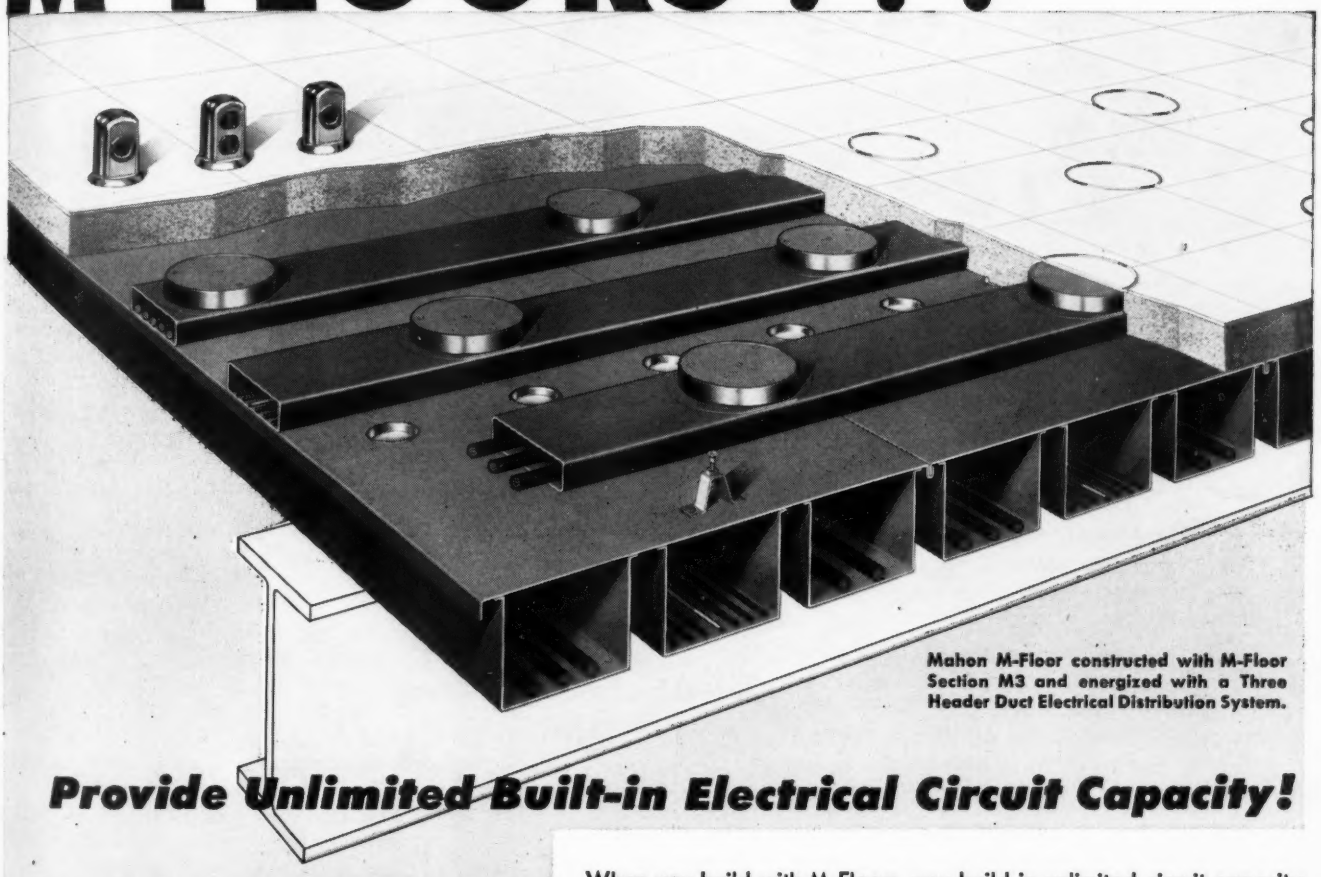
Hevi-Duty Insulating Transformers are available in a wide variety of standard models or may be engineered to your exact specifications. Send for Bulletin 499 or outline your requirements and our engineers will recommend a transformer for you.

HEVI-DUTY ELECTRIC CO.

HEVI-DUTY

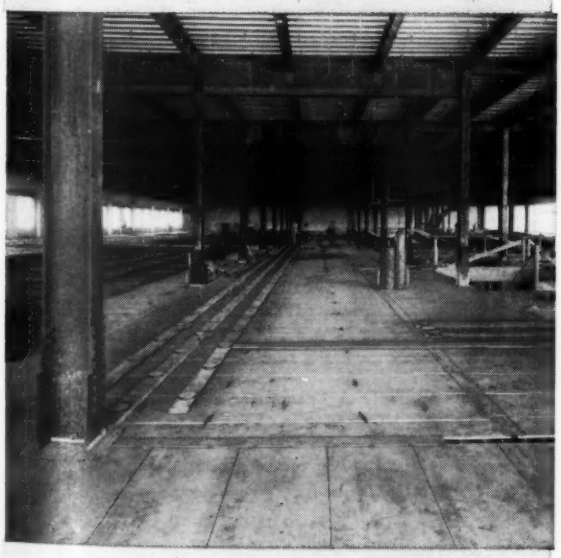
HEAT-TREATING FURNACES, ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

M-FLOORS . . .



Mahon M-Floor constructed with M-Floor Section M3 and energized with a Three Header Duct Electrical Distribution System.

Provide Unlimited Built-in Electrical Circuit Capacity!



The Mahon M-Floor Installation above is constructed with Mahon M-Floor Section M2 and energized with a Three Header Duct Electrical Distribution System. M-Floor Cel-Beam Sections are available with either Two or Three 6″ wide Cel-Beams in a 24″ width, and with One 6″ wide Cel-Beam in a 12″ width.

When you build with M-Floors, you build in unlimited circuit capacity for telephone, intercom, signal, and the various types of electrical service. It's there for the life of the building . . . all you have to do is drill a neat hole into a Cel-Beam Raceway and install a floor service fitting where you want it. Rearrangement of office space or moving of partitions poses no problem in buildings constructed with M-Floors . . . floor service fittings can be removed and relocated or additional fittings installed quickly, easily and without fuss or muss. This alone, should make M-Floors your choice for all new construction, but, in addition to this lifelong convenience, M-Floors have other advantages: Your building will cost less . . . the Strength/Weight Ratio of M-Floor construction will save up to 30% in the structural frame and foundation of some multiple story buildings. Your building will be built in less time, too . . . M-Floors go in as fast as the steel frame goes up. To derive full benefit from M-Floor construction, cost-wise, your building must be designed, structurally, for this type of floor . . . cellular steel floor construction, and the particular Cel-Beam Section to be employed, should, therefore, be your first planning decision. You'll find that M-Floors will meet your over-all requirements better. See Sweet's Files for complete information, or write for Catalog M-56.

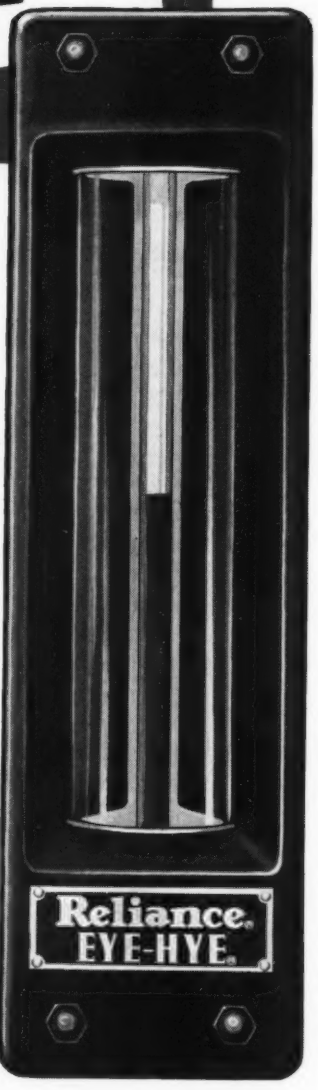
THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales-Engineering Offices in Detroit, New York and Chicago • Representatives in Principal Cities

Manufacturers of M-Floors (Electrified Cel-Beam Floor Systems), Insulated Metal Walls and Wall Panels, Permanent Concrete Floor Forms, Steel Roof Deck and Long Span M-Decks, Rolling Steel Doors Grilles and Underwriters' Labeled Automatic Rolling Steel Fire Doors and Fire Shutters.

MAHON

Newly Styled—
Wide Vision, Simplified Face
EYE-HYE®



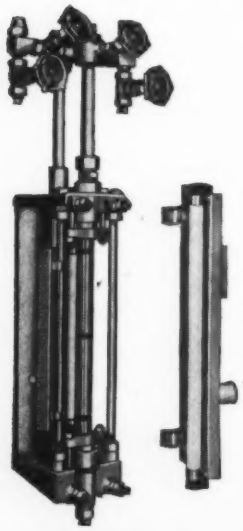
The Reliance Remote Reading Water Level Indicator

•

Accurate "liquid column" reading visible from large area because of brilliantly illuminated green liquid and wide angle face plate.

EYE-HYE is the original trouble-free manometric gage for dependable remote water level supervision. There's nothing new about its *operation,* but the new face plate and new illumination (fluorescent) make it easier to read all over the control room.

Simplicity is the secret of EYE-HYE's dependable full-range accuracy — no mechanical working parts — no adjustments on location. Supplementary alarms — lights or horns — can be added by equipping EYE-HYE with Reliance EA9-R Lev-alarm. Models for any remote gage need — any pressure. Write for Bulletin CO.



Fluorescent Illumination

Even lighting the entire length of the gage window is provided by a fluorescent tube. The fluorescent unit is available separately for installation in all but very old EYE-HYE models in use. Write for prices; mention the model number found on name plate.

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Avenue, Cleveland 3, Ohio

Corporate Engineering

Sir:

The article by Senator McCawley in the May issue ("The Corporate Practice of Engineering," p. 46) was so interesting that we are taking the liberty of having it photo-offset for distribution to our members . . .

You may not have seen the action taken by the ASME on April 6, 1956, and I am enclosing a copy which shows how they feel about amending the Model Law. (See News, p. 68 this issue). We are urging such amendment through the Founder Societies as it will tend to bring about uniform action throughout the country . . .

F. E. Lyford, Executive Director
Committee on Engineering Laws
New York, N. Y.

Sir:

I am enclosing a copy of a letter which I have addressed to Mr. C. B. Molineaux, who is Chairman of the EJC-ECPD Joint Committee on the Practice of Engineering. The principal problem before the committee is the so-called corporate practice of engineering.

It (article by Senator McCawley) is a very fine statement and may be the basis of agreement at least among the honest and sincerely professional people involved in this controversy.

W. F. Ryan, Vice President
Stone & Webster Engineering Corp.
Boston, Mass.

Swamped

Sir:

In your Scraps and Shavings (May issue) you have done it again. In a few short words you have eloquently reported on the current state of affairs with private practitioners in the U. S. A.

We are being swamped with requests for information. If you have a few tear sheets left over of said copy of Scraps and Shavings, I will be most grateful . . .

Joe Williamson, Jr., President
Missouri Association of
Consulting Engineers

Of Value

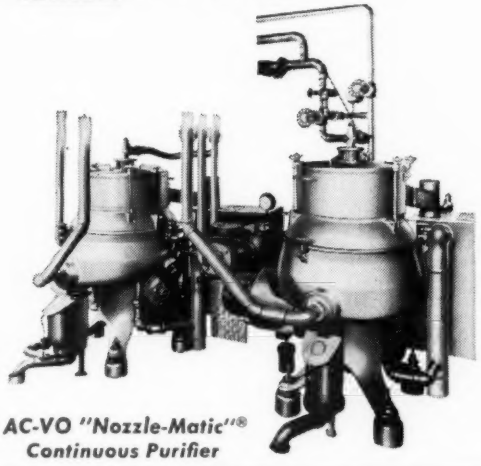
Sir:

I have had intermittent access to your publication for the past year and have found its current information, feature articles, and news items of considerable interest.

Harvey G. Hewitt
International Engineering Co., Inc.
San Francisco, Calif.

NOW...

Diesel Operation on Heavy Fuel Is Simply a Question of Which De Laval!...

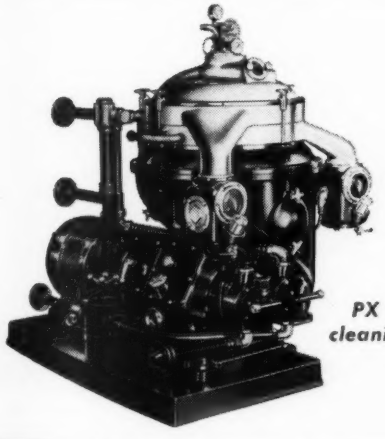


AC-VO "Nozzle-Matic"® Continuous Purifier

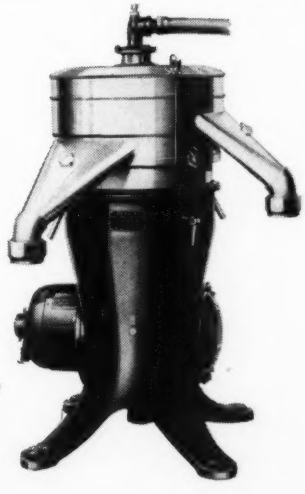
There is no longer any doubt as to both the *economy* and the *practicality* of burning residual fuels in diesel engines.

And, today, there is also no question of getting the *precise* centrifugal purifier to prepare heavy fuel for any particular set of circumstances . . . *De Laval* provides three different types. Each type has proved its efficiency and freedom from trouble in many installations, both land and marine.

Recommended capacities of each type are given below. Complete details on request . . . without obligation!



PX 209.00 Self-cleaning Centrifuge



Standard Purifier

RECOMMENDED CAPACITIES — G.P.H.

VIS.	TEMP.	AC-VO	PX 209. F	STANDARD PURIFIER
500	180° F	1200	600	300
700	180° F	1100	550	275
1700	180° F	660	330	165
2500	180° F	560	280	140
4000	190° F	440	220	110
5000	200° F	300	150	75

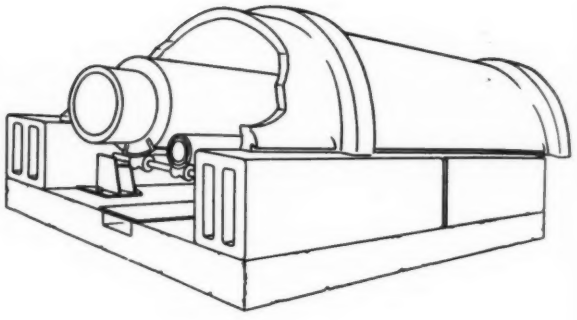
DE LAVAL

heavy fuel oil purifiers

THE DE LAVAL SEPARATOR COMPANY Poughkeepsie, New York • 427 Randolph St., Chicago 6 • DE LAVAL PACIFIC CO. 201 E. Millbrae Ave., Millbrae, Calif.

STILLWATER CONDUIT SYSTEMS

Made with Vitrified Clay For PERMANENT Protection of Underground Piping



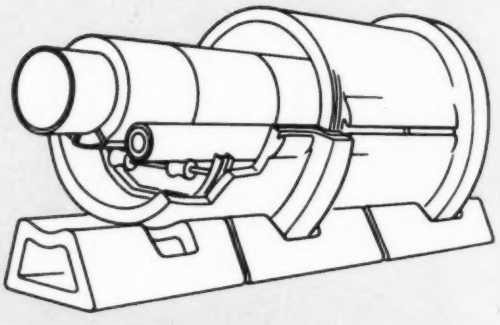
TUNNEL SYSTEM

. . . installed on a simple concrete pad. With Tunnel Arch in ten sizes and Side Blocks in three sizes, any combination of piping can be used.

When you're planning a conduit system to protect vital underground piping, five or ten years of corrosion resistance isn't enough. Good construction practice and sound business sense call for the *permanent* protection of a Stillwater Conduit System built with never-wear-out Vitrified Clay. Vitrified Clay is the *only* conduit material that is permanently safe against corrosion by ground water and chemical or electrolytic action of the soil. It's the only material that can't expand or contract with changes in temperature. It guards your underground service piping for generations—in fact, each component manufactured by Stillwater is *guaranteed for 50 years.*

A Stillwater Conduit System can be designed to handle any combination of service pipe the job requires. Experienced Stillwater engineers are ready to give you complete start-to-finish assistance in planning, estimating, and supervising construction of an efficient, trouble-free system.

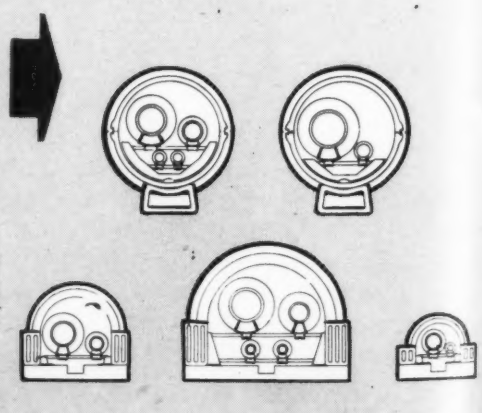
WRITE FOR the new Stillwater Conduit Systems Bulletin, with detailed product data.



ROUND SYSTEM

. . . supplied complete with combination underdrain and support structure. Available in 12 sizes, each with the proper underdrain support.

Diagrams show just a few of the hundreds of service piping combinations that can be protected with Stillwater Conduit Systems.



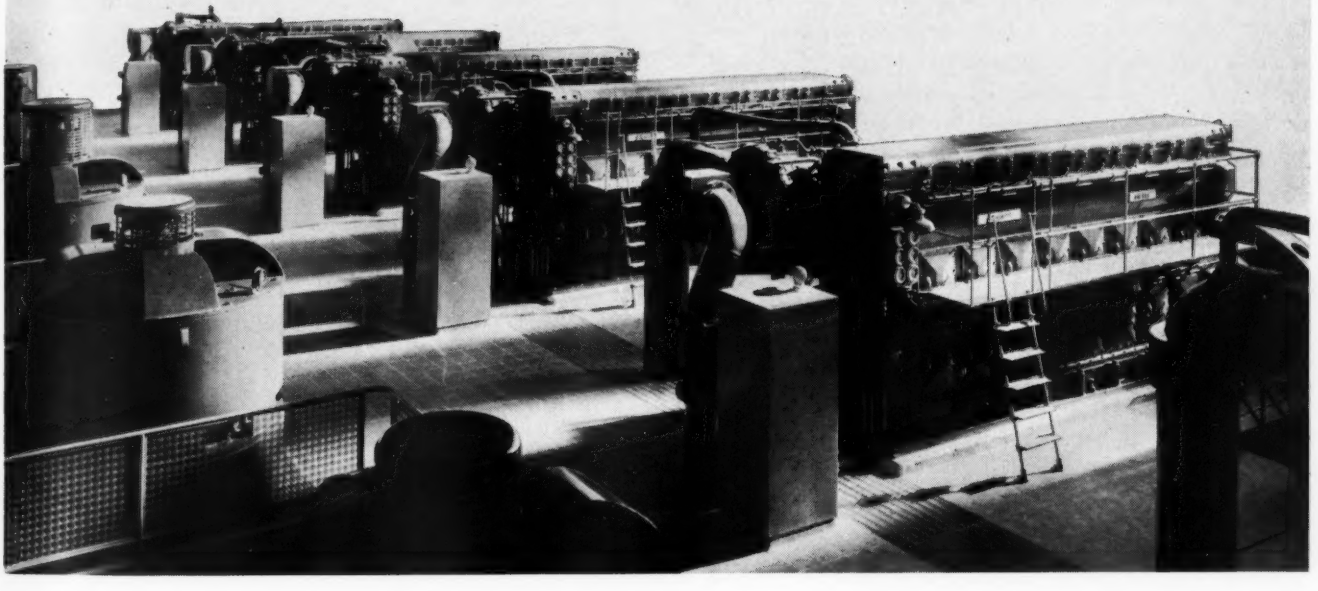
STILLWATER
CONDUIT SYSTEMS
DIVISION OF
THE STILLWATER CLAY PRODUCTS CO.
3334 Prospect Avenue, Cleveland 15, Ohio

SW-156-61

Superior DUAL-FUEL ENGINES

CUT OPERATING COSTS

in New York sewage treatment plant



Six Model 80 Superior Dual-Fuel Engines, operating 92% of the time on sewage gas, run six 1125 KVA generators to provide the sole power source for all plant equipment at The Department of Public Works, Owl's Head Sewage Treatment Plant, New York City, having a capacity of 160 million gallons per day.

After a total of 78,000 hours running time, the New York maintenance crew completed the first overhaul of the six Superior engines. Practically no major part replacements were necessary! There was no noticeable wear on the cylinder liners, bearings or other vital parts! Since the engines were torn down, piston rings were replaced; but the old rings were still good enough to save for spares! Records show very low lube oil consumption and pilot fuel costs figure out to only 9 tenths of a mill per KWH. This Superior performance is cutting operating costs to a bare minimum at New York's Owl's Head Plant!

Similarly outstanding performance records are being established throughout the U.S.A., and most other parts of the world where Superior and Atlas Diesels are used for all kinds of power needs. For complete details on how Superior and Atlas power can cut operating costs for you, contact the nearest sales and service office listed below.

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

WHITE DIESEL ENGINE DIVISION

THE WHITE MOTOR COMPANY • *Plant and General Offices: Springfield, Ohio*

SALES AND SERVICE POINTS: Gloucester, Mass. • Houston, Ft. Worth, Texas • San Diego, Oakland, Terminal Island, California • Ketchikan, Alaska • Washington, D.C. • Portland, Astoria, Oregon • Casper, Wyoming • Halifax, Nova Scotia • Vancouver, B.C. • Park Rapids, Minnesota • New York • Chicago • Seattle • New Orleans • St. Louis • Wichita, Kansas

Scraps & Shavings

THERE IS ONE ASPECT of professionalism seldom considered by engineers in private practice. Does the consulting engineer, as a professional man, have a duty to the public to take certain jobs at a financial loss to himself? Both the medical doctor and the lawyer understand that they may be called upon to take a case either without charge or for a fee that cannot cover the cost. Is there any such obligation for the consulting engineer?

No one would suggest that the consulting engineer is under any obligation to design a power plant free for a financially embarrassed public utility — nor need the consultant have any pangs of professional conscience if he refuses to handle the air conditioning project for his city auditorium, at a loss to himself. He would, in fact, be open to professional criticism if he were to take such jobs on a charity basis. Other consultants who were striving to maintain a stable organization and who were conscientiously aware of the problems of meeting their payrolls would have a right to be resentful.

There are, however, instances in which it would seem that the consulting engineer, as a professional man, has the duty to do work at a loss. For example, most consultants have been called upon to give professional advice or write specifications for very small jobs. Every consultant who does air conditioning and heating can expect a few calls every year from the owner of a small grocery store, a delicatessen, a club house, or even a residence, who wants to know what he should do about air conditioning or heating for his establishment.

The cost of equipment and installation may run between $500 and $1000 — perhaps even less. The fee might be as little as $50.00, yet a man would have to be sent out to gather the data, and the total job of calculating the load, selecting the proper piece of equipment, and checking its installation might take a man's time for two or three days. Not only would this be a loss to the consulting firm, but when the bill for the fee is sent, the client usually thinks it is too high. And as a layman he cannot be expected to recognize the value of the service he received.

This type of job loses money, irritates the man assigned to it, loses friends, and does nothing to distinguish the consultant. Why fool with it at all? Why not put a minimum fee of $250 or $500 on any job and simply refuse to take any of the dogs?

That can be done. It is being done in one way or another every day. But it is unprofessional. What would the public think of a doctor who refuses to bandage a cut hand because he never deals with anything less than an appendectomy? What about the lawyer who is too busy with corporate cases to be able to draw a will or record a piece of property?

This does not mean, of course, that there cannot be specialists. The eye, ear, nose, and throat man can well refuse to treat a stomach ulcer, but he should not refuse to get a cinder out of an eye because it is too unimportant a job. A lawyer can confine his practice to civil law and refuse a criminal case, but such a man would be wrong to turn down a request for legal advice in his field because the job was too small.

Similarly, the consulting engineer who does largely highway work has every right to refuse to take a mechanical project, but the mechanical engineer who will not take, at his regular fee, a heating job because it is too small is conducting something less than a professional practice.

The consulting engineer stands in a particularly vulnerable position. He screams loudly and with genuine pain when a manufacturer's representative or a contractor does the engineering on a large and profitable project. But when the corner grocer wants an air conditioning system installed, "That's the kind of job for the equipment salesman or the contractor." In other words, "We will handle the big operations, but if it is less than a broken leg, let the patient go to the drug store."

The consultant has no more right than the contractor or the salesman to decide what is big and what is little. A lot of jobs fall somewhere in between. On these, if the consultant is busy at the time, it becomes a "little" job, and the contractor can handle it. If the consultant is looking for work, it becomes a "big" job, and the contractor who takes it is invading the engineer's rightful domain.

It cannot work that way. The consultant offers his services to the public, and his offer cannot be considered professional until he understands that it includes a willingness to take the small as well as the large projects. Turning the unprofitable jobs over to the manufacturer or the contractor is not the answer to the problem. ▲▲

This circuit breaker can pay for itself in 15 seconds

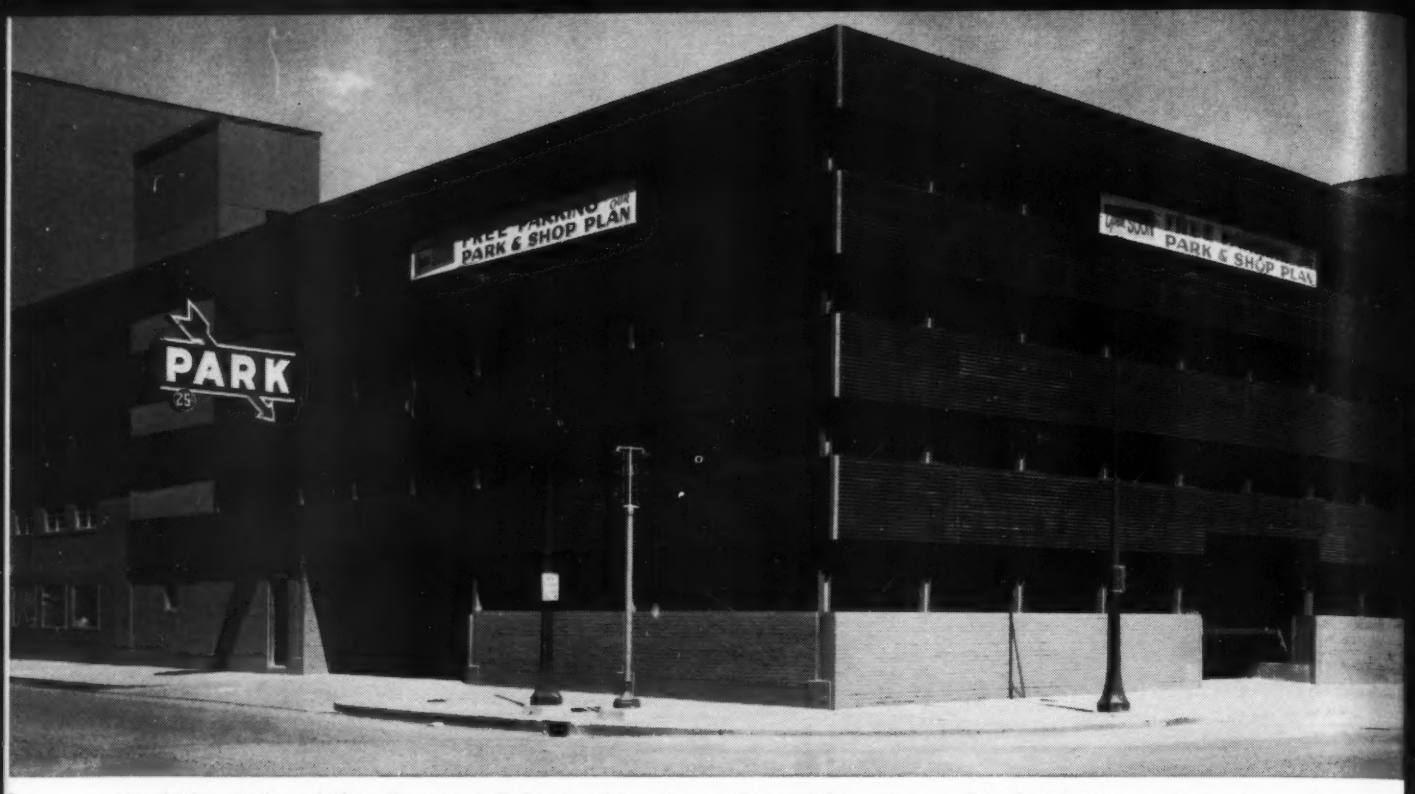
Snap! And the power is on again. It's that simple with a Westinghouse AB De-ion® circuit breaker. Unlike other protective devices, it quickly restores power with just a simple flick of the finger—no valuable time wasted looking for fuses, no fuse replacement costs, no need even to call a maintenance man. The trip position of the breaker handle quickly identifies the affected circuit.

Today's buildings—with a wide range of electrical equipment from fans to floodlights—require positive insurance against overloads and short circuits. And when overloaded circuits go dead and business stops cold, that's when Westinghouse circuit breaker protection pays for itself many times over by restoring electrical service quickly, effortlessly—with practically no loss of valuable time.

When you consider circuit protection for today's buildings, it will pay you (and your clients) to specify Westinghouse AB circuit breakers. Your Westinghouse representative can offer you a complete range of circuit breakers for every application. Call him, or write to: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-30193

WATCH WESTINGHOUSE!

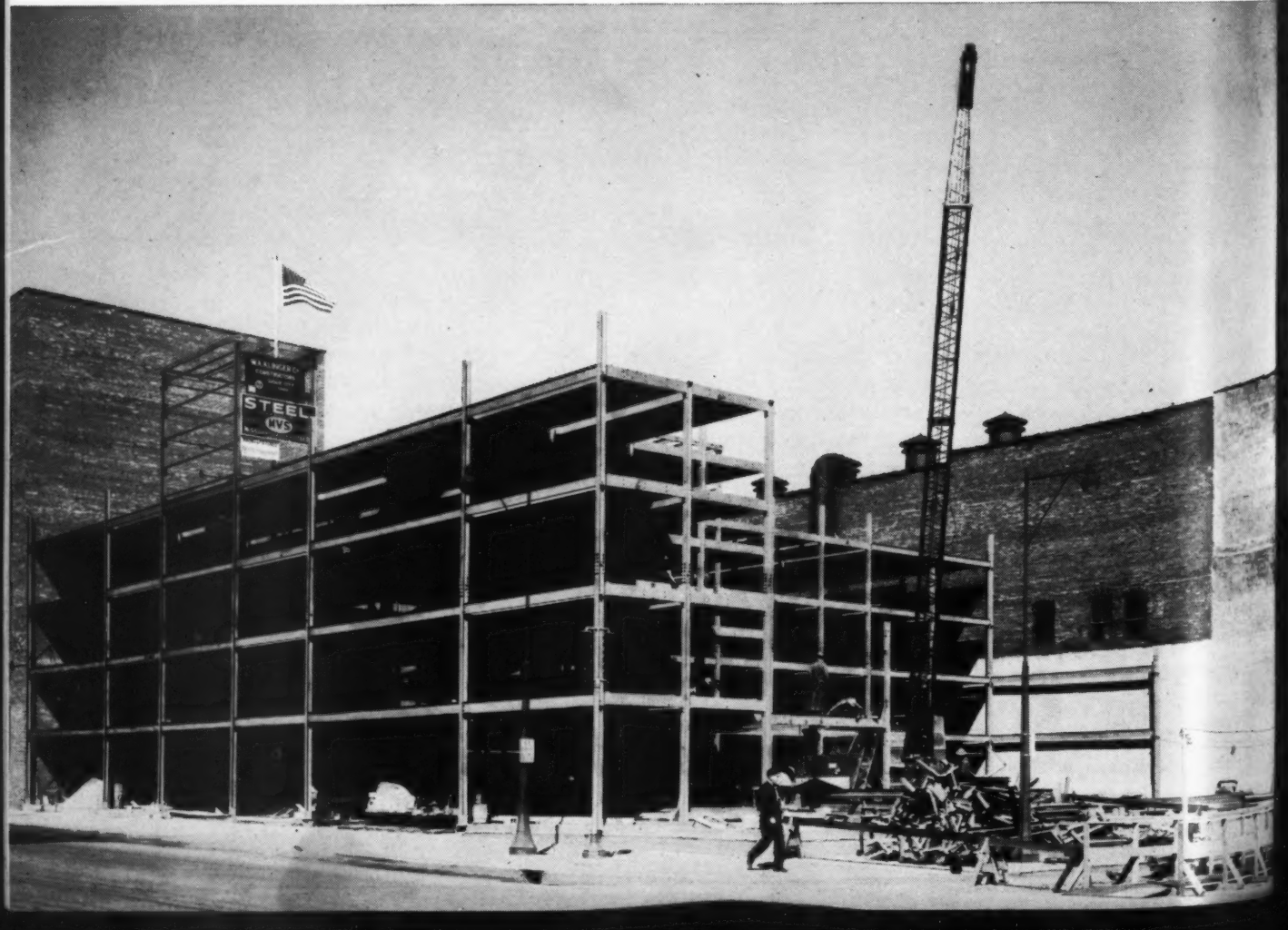
*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU***



Hotel West Park and Shop Garage, L. B. Longnecker, Owner. **General Contractor and Architect**—W. A. Klinger, Sioux City, Iowa.

"Economy Package

Structural Steel framework during erection. The 500 tons of Structural Steel were fabricated by the Missouri Valley Steel Company, Sioux City, Iowa.



Connections were made between all structural members by means of bolts—one of the fastest and quietest methods of erection.

parking garage

virtually an all-steel structure

This unique, four-deck parking garage in Sioux City, Iowa, comes as close to being a prefabricated building as is possible without actually being one. The 500-ton Structural Steel framework was erected and bolted in jig time. 223 tons of USS Multigrip steel floor plate were laid. Wiring and a minimum of brickwork were accomplished, and the job was done. Total erection time—8 weeks.

For low-cost, fast construction, where strength is of vital importance, Structural Steel is the only practical material to use. Its architectural versatility encourages its use in virtually every type of municipal undertaking, from schools to government buildings to airports.

Here's what Structural Steel has to offer you:

1. Structural Steel is the *strongest,* yet most economical of load bearing materials.

2. Structural Steel will withstand more abuse than other structural materials, effectively resisting torsion, tension, compression and shear.

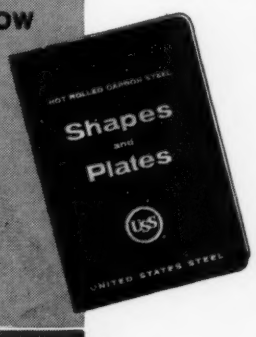
3. Once enclosed in buildings, it lasts indefinitely—requiring no maintenance.

4. Structural Steel may be bolted, riveted, or welded . . . can be erected in any weather in which men can work.

5. Steel members are fabricated indoors; therefore, weather can have no effect on the quality of workmanship.

USS STRUCTURAL STEEL

SEND FOR THIS FREE BOOK NOW



UNITED STATES STEEL CORPORATION, PITTSBURGH
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL

United States Steel Corporation
525 William Penn Place, Room 5242
Pittsburgh 30, Pennsylvania

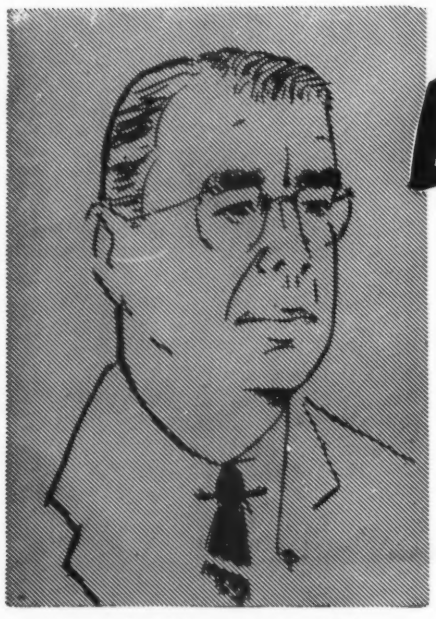
Please send me a free copy of HOT ROLLED CARBON STEEL SHAPES AND PLATES.

NAME .....

COMPANY .....

ADDRESS .....

CITY ..... STATE...



ECONOMIC News Notes

E. F. MacDonald
INDUSTRIAL ECONOMIST

QUOTE-OF-THE-MONTH — As this is written, the economic situation is marked by developments that some see as a prelude to a fairly serious decline and which others analyze as a period of hesitation before further rises in the general level of business activity. The complex of strong and weak areas in the economy and of favorable and unfavorable developments make apropos a quotation from "What Happens During Business Cycles" written by the late Prof. W. C. Mitchell, the authority on business cycles. He pointed out, "Crosscurrents in the business situation are most prominent in the last segment of cyclical expansion and the last segment of cyclical contraction."

LONG-RUN STRENGTH — An expression that finds favor, or at least considerable use, among business analysts is, "The business outlook is unusually difficult to forecast at the present time." And as the economy moves toward the end of the first half of 1956 on the high plataeu at which it leveled off in late 1955, it is indeed difficult to "lift the veil" and foretell what is in store for the next six months. But regardless of short-run developments, Mr. H. E. Luedicke, editor of "The Journal of Commerce," contends that the economy retains great underlying strength for the longer pull. Population increases and technological gains, he holds, point to economic growth.

CONSTRUCTION LINK — The age group 18-24 will be a significant one to keep tabs on from now on. This is the college-age group, and it's at the low point of the downtrend it has been following since the end of World War II. Census projections indicate a substantial growth in this field at a fast rate — a 66% increase by 1970. No slide rule is needed to hook this up with an increasing volume of construction of college facilities.

NEAT TRICK — Stating recently that it is virtually impossible for New York school districts to borrow money at interest rates they can afford, N. Y. State Controller A. Levitt called for a revision of Federal policies that would maintain anti-inflation measures without slowing down public construction.

TURNING POINT — The layman is puzzled by the fact that despite all the "hooraw" about the shortage of engineers since the end of World War II, the situation doesn't seem to be improving. Generally, however, when there's a shortage of anything, market forces operate over the long run to correct the fundamental causes of the scarcity. Last year, for the first time in the postwar period, there was an increase in engineering degrees as a percent of total bachelor degrees granted. The trend of engineering enrollment, as a percent of total college enrollment, reversed direction in 1951 and has moved up from a postwar low of 7.8 in 1951 to 8.9 this past year.

NEW ERA — Upon receiving approval for construction of a heliport at 30th Street and the Hudson River in New York City, the Port of New York Authority announced the desirability of building five more heliports in the N. Y. Metropolitan Area.

CONSTRUCTION REPORT — Reflecting the increased importance of business investment in total construction activity, the Department of Commerce reports that private outlays for commercial, industrial, and utility projects rose from 33% of total private construction outlays in 1955 to 36% in the 1st quarter of this year. The dollar volume (seasonally adjusted annual rate) of construction put in place during the 1st quarter was slightly greater than a year earlier, but after allowing for higher construction costs, the physical volume was about 4% lower than in the same period a year ago.

REVIEWED AND CONFIRMED — Back in February at the annual convention of the Associated General Contractors of America, Inc., H. E. Foreman, managing director, forecast a record level of $60 billion of construction outlays this year. Although new construction expenditures in the first four months of this year were just about the same as a year earlier, F. J. Rooney, president of the organization, feels that the $60-billion mark may still be approximated. He looks for new construction to reach $44.5 billion and for maintenance and repairs to total up to $15 billion. He believes the impact of tight money will be felt most in state and local construction.

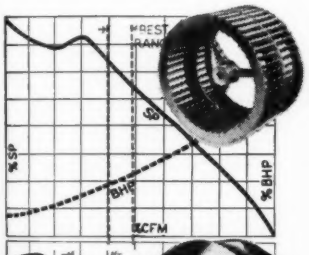
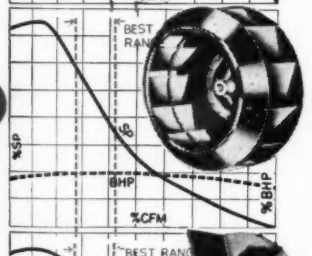
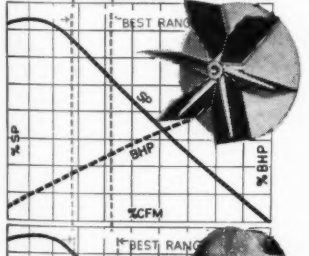
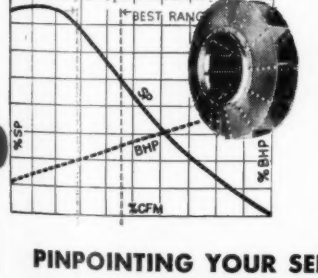
THROUGH THE TRANSIT — In 1955, highway contractors operated at 53% of capacity. According to the American Road Builders Assoc. they could successfully undertake a $7.8 billion highway construction program with practically no expansion of present organizations and equipment. . . . Rosa Multiflora Japonica, a plant used as a border barrier along highways, is reported in "Highway Highlights" ab'e to stop a car traveling at 50 mph even in wintertime when plant has no foliage.

Bayley

FAN-A-GRAFICS
For Equipment Engineers

Selecting Centrifugal Fans

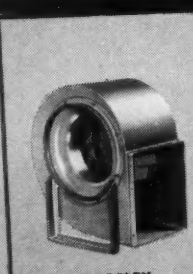
FACTORS TO PREDETERMINE: Volume — Pressure — Duty — Space... These are the factors to be evaluated at the outset in selecting a Centrifugal Fan. Next, determine the best type and size. This involves a screening process requiring a good working knowledge of various fan characteristics, as outlined below:

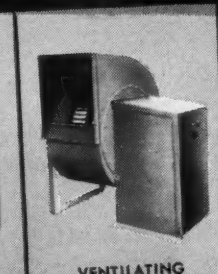
	BAYLEY TYPES	PRINCIPAL APPLICATIONS	PRINCIPAL ADVANTAGES
	**TYPE F** Forward-Curved Multiblade Wide Wheel Wide Scroll Large Outlet Shallow Inlet	General Clean Air Ventilation and Air Conditioning Induced Draft, Gas or Oil-Fired Package Boilers Packaged Air Conditioners Multiple Fan Units Motor & Electronics Cooling Small Volume Requirements	Minimum space for given volume handled High manometric effect with low tip speed, especially for small fans High efficiency, quiet operation High Volume/Pressure change ratio gives sensitive volume control High blade frequency for ease of noise isolation
	**TYPE AP** Backward-Curved Multiblade Narrow Back-Plate Wheel Wide Scroll Large Outlet Deep Streamlined Inlet	General Clean Air Ventilation and Air Conditioning Forced Draft Industrial Process Air-Handling Drying and Kilning Large Volume Fume Removal	Non-overloading power characteristic Good driving speeds for medium and large sizes Highest efficiencies, quiet operation Low Volume/Pressure change ratio gives sensitive pressure control Wide selection range Low outlet velocity at peak efficiency
	**TYPE EX** Open Radial 6-Blade Medium Width Back-Plate Wheel Medium Width Scroll Medium Outlet Free Inlet	Materials Handling Exhaust Ventilation Oven and Furnace Draft & Circulation High-Temperature Gas Handling Pneumatic Conveying through Fan	Non-clogging wheel Abrasion and corrosion resistance readily incorporated Medium pressure range Medium speed Good efficiency Wide selection range
	**TYPE H** Closed Radial 12-Blade Narrow Back-Plate Wheel Narrow Scroll Small Outlet Free Inlet	Blow-Through Pneumatic Conveying Pressurizing or Vacuumizing Forced Draft Packaged Units Large Induced Draft Cupola Blast Blast Cleaning	Medium speed High pressure, low volume Readily matched to motor speed for direct connection Good efficiency High-Strength wheel for extreme pressures Wide selection range

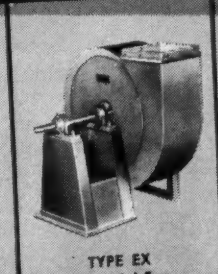
PINPOINTING YOUR SELECTION: Consult the curves or tables for size determination. Multiblade fans are available in single and double widths to meet variable space limitations. Check tentative selection for suitability to drive and control requirements of the installation. Curves above illustrate basic volume-pressure relationships from which comparative effects of variable performance requirements can be evaluated. For more facts about Fan characteristics, ask for our free engineering manual.

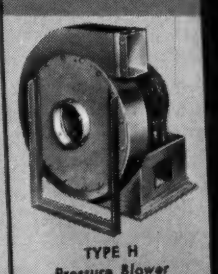
Whatever your requirements, Bayley has the type and size to do the best job.

PLEXIFORM
Forward Curve


AEROPLEX
Backward Curve


VENTILATING SET


TYPE EX
Industrial Fan


TYPE H
Pressure Blower

Engineered
AIR HANDLING EQUIPMENT

BAYLEY BLOWER COMPANY

6610 W. Burnham Street
Milwaukee, Wisconsin

ATOMS IN ACTION

ESSO RESEARCH & Engineering Co. has signed a $250,000 per year contract with Battelle Memorial Institute for experiments aimed at finding ways to use nuclear radiation in production of petrochemicals and in petroleum refining. This brings Esso's annual expenditure for nuclear studies to over $1 million.

FABRICATION of welded vessels with greater wall thicknesses than now feasible are expected to result from use of the 1 and 2 mev Van de Graaff X-ray generators ordered by Chicago Bridge & Iron Co. from High Voltage Engineering Corp. The Van de Graaffs will be used for inspection of storage and pressure vessels and investigations of nuclear reactor chambers.

WESTINGHOUSE scientists have devised an "ultra-fast" method of vulcanizing silicone rubber that produces a better rubber in two seconds than conventional methods produce in several hours. Key to the system is use of a 2 mev electrostatic generator. No heat, pressure, or chemicals are necessary.

A THIRD INSURANCE PLAN, this one proposed by Clinton P. Anderson, provides for a governmental indemnity over and above a reasonable amount of third party liability insurance to be provided by private insurance companies or syndicates. A $500 million ceiling would apply for any one disaster, with sums over this amount handled by special legislation. The reactor operators and equipment manufacturers would be liable to the extent of their private insurance coverage. Under this proposal, the government would assess a minimum charge per year per reactor. The Joint Congressional Committee on Atomic Energy hearings during the week of May 14 considered this proposal and the bills prepared by Representatives Mel Price and Sterling Cole.

THE AEC "has approved in principle" the nuclear power plant proposals of the Rural Cooperative Power Association, of Elk River, Minn., and the Wolverine Electric Cooperative, of Big Rapids, Mich. Both proposals request that AEC finance and retain title to the reactor portion of the plant. Contracts for AEC assistance are contingent on loans requested by the cooperatives from the Rural Electrification Administration.

THE DRAFT STATUTE for an International Atomic Energy Agency has preliminary approval of the representatives of 12 nations assigned by the UN to work out a feasible plan. Next step will be a general international conference in September of all UN member nations and its specialized agencies. The Board of Governors, major stumbling block to agreement, was set at 23 members, each with one vote. The Agency would have its own staff of inspectors, with the Agency authorized to send these inspectors into the recipient nation to determine compliance with terms of the agreement with the Agency. Regular reports on activities would be submitted by the Agency to the UN General Assembly and, when appropriate, to the Security Council.

"THE SMALL BUT IMPORTANT" increase in yield resulting from use of by-product isotopes during petroleum cracking has been estimated by one oil company to represent a potential increase in its profit of from $25 to $50 million per year, according to C. W. Wallhausen, speaking at the Atomic Forum meeting in Atlanta, Ga.

AN INTENSIVE COURSE on "Nuclear Reactors & Radiations," aimed at the practicing engineer, will be offered by the University of Michigan's College of Engineering from August 20-31. Fee for the course is $200. For information write to Professor William Kerr, 2513 East Engineering Building, U. of M., Ann Arbor, Mich. Probably the newest idea in the nuclear engineering education field is a home-study course of 39 lessons, developed by the Institute of Scientific Studies, 248 Arlington St., Elmhurst, Ill.

A NUCLEAR ENERGY Engineering Committee has been formed by the American Society of Heating and Air-Conditioning Engineers, under chairmanship of Ralph A. Sherman, of Battelle Memorial Institute. Members are: Walter F. Friend, Ebasco Services. Inc.: Walter A. Grant, Carrier Corp., L. N. Hunter, National-U.S. Radiator Corp.; and B. H. Jennings, Northwestern University.

TWENTY TECHNICAL SOCIETIES in the Pittsburgh area have established a Pittsburgh Nuclear Activities Council to coordinate their activities and to encourage development in the nuclear energy field. E. B. Gunyou, of Koppers Co., is president.

THE FIRST PERMITS for private construction of large scale atomic power plants have been issued to Consolidated Edison Co., of New York and Commonwealth Edison Co., of Chicago. Upon submission of a final "hazard summary report" by the two companies, and a determination by AEC that the final design provides adequate provisions for the health and safety of the public, the construction permits will be converted to 40-year licenses.

THE ATOMIC INDUSTRIAL FORUM, Inc. will move to new and larger quarters in July. Address will be 3 East 54th Street, New York City.

Air Conditioning's #1 Problem...

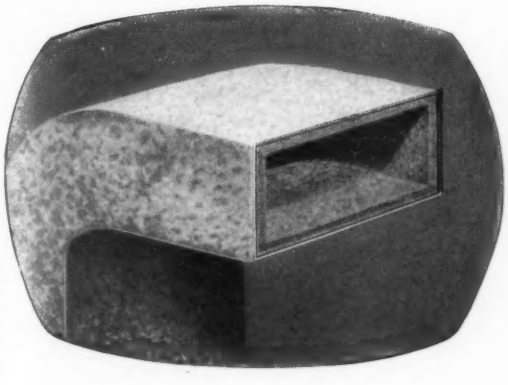
how to move air without "FAN-FARE"

Recent studies show that noise control is one of the prime problems of air conditioning today. Time and again, homeowners and businessmen complain that "fan chatter" and other objectionable noises seriously interfere with their rest and work.

The best possible way to keep your comfort-cooling customers from getting hot under the collar about noise is to install a few feet of ULTRALITE* Duct Liner in the plenum and short supply and return ducts. It's easy . . . it's inexpensive . . . it's effective — yet this simple precaution can make all the difference between a satisfactory and an unacceptable air conditioning job.

That's why it is good practice today for architects and engineers to specify ULTRALITE glass fiber duct liner on every job. That's why contractors who want nothing but satisfied customers line ducts even on jobs where duct liner is not specified.

*Reg. U. S. Pat. Off.



ULTRALITE is a flexible, semi-rigid glass fiber insulation designed specifically as an acoustical duct liner, with excellent sound-absorbing properties. Because of its unique long textile-type glass fiber composition, ULTRALITE is the strongest, most resilient glass fiber insulation. That's why it will not break, chip, delaminate or flake off in the air stream. ULTRALITE is available coated one side to minimize air friction loss. Local stocks in 57 cities are maintained to give you delivery when and where you need it. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon Insulations."

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Railroad gaskets and supplies

212 W. 10th St., Kansas City, Mo.

The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Sales (III)

LAST MONTH, the following problem was posed:

On Jan. 27, 1931, a written contract was made for the sale by P to D of a machine for the automatic packing in cartons of "Tastyeast bars" made by D. The contract provided: "The machine will be sent on 30 days trial, entirely subject to your approval before acceptance. If machine is not satisfactory to you in any way and is not accepted, we will, upon receipt of notice to that effect, receive said machinery without any charge to you. If the machine is not accepted you are to return it to us and at that time your every obligation to us will cease. If accepted, the price becomes due at the expiration of the 30-day trial period."

The machine arrived at D's factory on April 4, 1931, and was found (by the jury) to be capable of performing as required by the contract. D made no complaint until Aug. 25, 1931, when it declared the machine to be unsatisfactory and offered to return it. Was D liable for the purchase price?

Held: Yes. This was a sale on approval, and therefore title did not pass unless and until D accepted and approved the goods. Although he never explicitly stated that he approved the goods, failure to reject them within a reasonable time after the expiration of the 30-day trial period amounted to acceptance and approval. Therefore, title passed and D is liable for the purchase price. R. A. Jones & Co., Inc., *vs.* Green Bros. Co., 193 N.E. 582 (1935).

Express Warranties

An express warranty is a representation of fact or a promise made by the seller orally, in writing, or implied from the facts, that relates to the goods and is an inducement to the buyer to purchase the goods. If it is a promise (e.g. that the goods will be of a certain quality), and it is not fulfilled, the buyer can regard this as a breach of contract and sue for damages. Or he may rescind the transaction altogether. This much is familiar contract law.

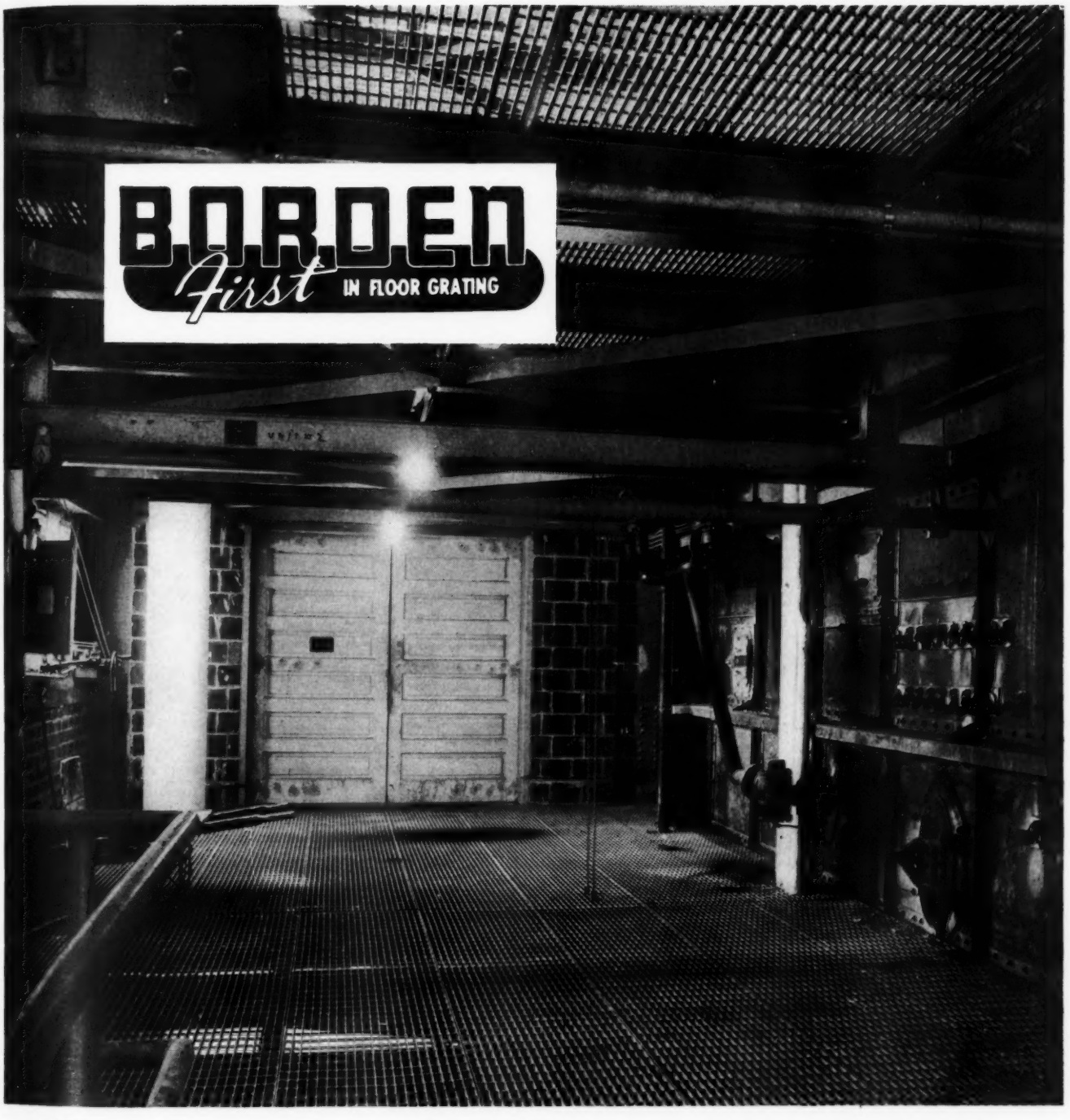
On the other hand, if the warranty is a representation (e.g. that existing goods are of a certain quality), which happens not to be true (regardless of whether or not the seller knew of the incorrectness of his representation), it is clear from contract law that the buyer can rescind the transaction on account of the misrepresentation. However, it is not obvious (though it is true) that the buyer can, at his option, sue the seller for damages, just as if there had been a breach of contract. The reason this is not obvious is that there has been no broken promise, but merely a misrepresentation of fact. Nevertheless, in the case of a contract to sell or a sale of goods, the law requires the seller to make good his representations concerning the goods, whenever they induce the buyer to purchase.

Opinion Not a Warranty

Certain types of representations are not regarded as express warranties, since it is held that there is no right to rely on them. Mere statements of value or opinion or seller's "puffing talk" (e.g. "the best buy in town") are not warranties.

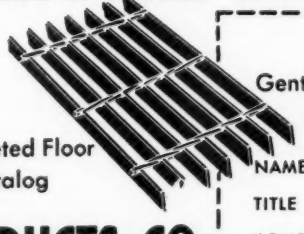
The following is an example of a problem involving express warranties:

A entered into a contract with B whereby A was to construct and deliver a spray drier for drying 100 gallons per hour of licorice liquor. The machine lived up to expectations only if operated for a period of not more than about 10 hours at a time. If operated continuously 24 hours a day, the product was scorched. The buyer claimed that the seller had warranted continuous operation. The buyer had asked in writing that the seller guarantee



Q. **Where can I find an inexpensive, light, fireproof, completely ventilated flooring?**

A. **BORDEN ALL/WELD floor grating in this installation furnishes all the above features — PLUS — it is self-cleaning and Borden All/Weld floor grating is solidly welded without cracks or crevices — to eliminate corrosion.**



Write for complete information on BORDEN All/Weld, Pressure Locked, and Riveted Floor Gratings in this FREE 8-page catalog

BORDEN METAL PRODUCTS CO.

817 GREEN LANE Elizabeth 2-6410 ELIZABETH, N. J.
SOUTHERN PLANT—LEEDS, ALA. — MAIN PLANT—UNION, N. J.

BORDEN METAL PRODUCTS CO.

Gentlemen:

Please send me BORDEN Catalog #AT254.

NAME _____

TITLE _____

COMPANY NAME _____

ST. AND NO. _____

CITY AND STATE _____

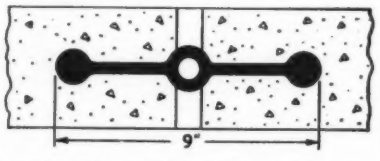
Water Leakage Problems IN CONCRETE STRUCTURES?

—Specify and use Servicised

RUBBER WATERSTOP

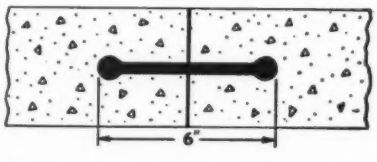
HOLLOW BULB—FOR EXPANSION JOINTS

Insures permanent, watertight seals in joints where considerable movement due to expansion and contraction is expected. Flexible and elastic with a very high degree of tensile strength to withstand both lateral and shearing movement. Widths—6" and 9" . . . lengths to order.



FLAT DUMBBELL—FOR CONTRACTION OR EXPANSION JOINTS

Made of durable, elastic cured rubber which has high tensile strength and flexibility for effective sealing of contraction and expansion joints against hydrostatic pressure. Carefully manufactured to insure dense, homogeneous cross section for greatest service life. Widths—6" and 9" . . . lengths to order.



SPLIT TYPE WATERSTOP

faster, easier installation

A new Servicised development already in wide use because it reduces installation time and cost by eliminating splitting of form. One half of width is split to permit fastening to inside of bulkhead in the form of a "T." After section is poured, form is removed and divided sections are joined together by stapling. Pat. Pend.

WATERSTOP UNION

simplifies Field Splicing

Permits a faster, simpler method of field splicing, using only rubber cement. The union is hollow and is made from rubber meeting the same specifications as the waterstop. Available for splicing 6" and 9" Dumbbell and 6" and 9" Hollow Bulb Waterstops. Pat. Pend.

Write for Special Waterstop Catalog.

SERVICISED PRODUCTS
CORPORATION
6051 WEST 65th STREET • CHICAGO 38, ILLINOIS

evaporation of 100 gallons of water per hour 24 hours a day. In answer, seller said in writing that the machine was designed for the evaporation of 100 gallons per hour and guaranteed it, but made no mention of 24-hour-a-day operation. The evidence showed that both parties had been contracting with respect to a drying machine that would operate on a commercial basis, and that the seller's experiments were all conducted with the purpose of producing a machine that would operate continuously. The seller also claimed to be excused because the trouble is in the inherent nature of licorice, which no one can control, and pointed in particular to a provision in the contract that said, "All agreements are contingent upon causes beyond our control."

Is the seller liable for breach of warranty?

Held: Yes. Taking the agreement as a whole, including all the writings and surrounding circumstances, the court held there was an express warranty for 24-hour operation of the machine. The warranty is not explicit, but is implied from the facts. The provision relating to "causes beyond our control" is not held to refer to inability of a party to accomplish what he has set out to do, but refers to unexpected risks that were not intended to be undertaken by him, such as strikes, shipping conditions, and acts of God or the public enemy. It is not sufficient to negative the warranty. Mac Andrews & Forbes Co. *vs.* Mechanical Mfg. Co., 11 N.E. (2d) 382 (1937).

Implied Warranties

When a seller gets into trouble because of an expressed warranty, he generally gets little or no sympathy, because he brought it on himself. However, he can also get into trouble because of implied warranties without having misrepresented anything or broken any promises.

An implied warranty is one that arises by operation of law. It is not an explicit promise or representation, nor is it implied in fact. It is "there" simply because, under

certain circumstances, it is the policy of the law to protect buyers.

The following implied warranties are provided for in the Uniform Sales Act: implied warranty of title in the seller; implied warranty of quality or fitness; and implied warranty that the goods correspond with their description and with the sample, if any.

Clear Title

The implied warranty of title includes a warranty that the seller will have title to the goods when the title is supposed to pass. The seller also impliedly warrants that the buyer will enjoy quiet possession of the goods, and that the goods will be free of any charge or encumbrance unknown to the buyer.

Quality and Fitness

The implied warranty of quality or fitness arises only when the buyer discloses to the seller the purpose for which the goods are to be used, the seller permits the buyer to rely on the seller's skill or judgment in selecting the appropriate goods, and the buyer does so rely. If the buyer inspects the goods, he relies on his own judgment insofar as defects which such examination should reveal. Furthermore, if the buyer selects the quality of goods by ordering under a recognized trade name, there is no implied warranty of fitness by the seller.

The rules relating to warranties —especially implied warranties— constitute a trend away from the old rule of *caveat emptor* (let the buyer beware). According to this rule, it is up to the buyer to determine the quality of the goods and the accuracy of the seller's statements. *Caveat emptor* is still the rule, except insofar as the rules relating to warranties conflict with it.

Disclaimers

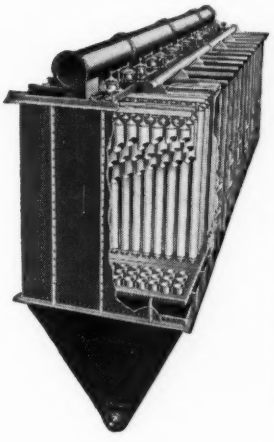
The parties to a sale are free to fix whatever terms they choose. If they wish to avoid the possibility that a court will find warranties that the parties did not intend, they can expressly disclaim them. They can disclaim the existence of specific warranties,

Norblo solves dust problems

Whatever you need in dust or fume control, be sure to check *Norblo*

In Bag Type, Centrifugal or Hydraulic dust collecting systems, Norblo Dust and Fume collection equipment has many design advantages. These three types, frequently used in certain combinations, provide economical dependable control as required in smelting, rock products, chemical, milling and processing fields.

What is the best approach to your dust problems? Norblo helps you select—applies engineering skill and "know how" gained in first hand experience of over 40 years in many industries.



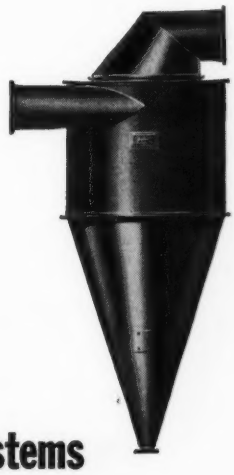
Norblo Bag Type Systems

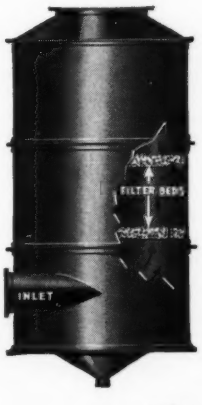
Automatic and Standard

For continuous or heavy duty service providing very high efficiency at very low cost of operation and maintenance. Basic unit contains 78 bags, 6″ diameter, 8′ 3″ long. Air flow is upward, from inside, thus keeping bags fully distended. Total free cloth area per compartment 936 square feet. Shaking and cleaning controlled by electric timer, is cyclic, one compartment at a time, each having its individual compressed air shaker mechanism and the whole system variable and adjustable for dust load without shutting down . . . Also Norblo Standard Bag Type (non-automatic).

Norblo H. E. L. S. Centrifugal Systems

A cyclone or centrifugal type collector for all materials, from sawdust to fly ash; characterized by high efficiency of collection with low static drop. The Norblo H. E. L. S. has no internal vanes, gadgets or dampers. High efficiency is obtained by scientific proportioning and by the patented (No. 2,259,919) expanding nozzle. These design features eliminate the power-wasting back eddy. Built in standard sizes with capacity up to 37,500 cfm.





Norblo Hydraulic Systems

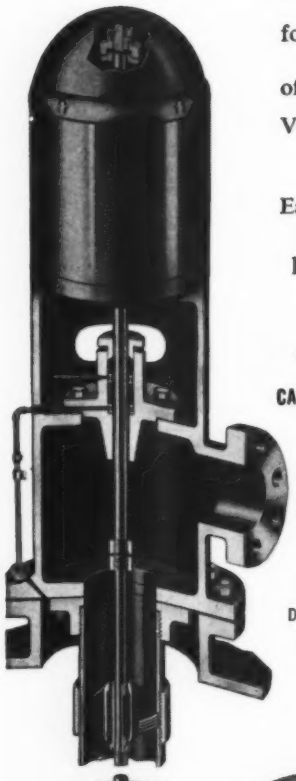
A high efficiency, wet type collector, for separation of dust mixed with smoke or fumes. In most installations the Hydraulic unit is used with a Norblo Cyclone collector, thus reducing the amount of wet sludge to be handled. No moving parts. Filter beds are coke or high-fired ceramic tubes, light weight and kept in motion by ascending air stream. Beds are self-cleaning. Built in standard sizes with capacities up to 26,000 cfm.

Take advantage of the efficiency and low maintenance available through Norblo Equipment in these three proved systems of dust and fume collection. Write for full information.

The Northern Blower Company
6426 Barberton Ave., Cleveland 2, Ohio • OLympic 1-1300

Norblo ENGINEERED DUST COLLECTION SYSTEMS FOR ALL INDUSTRIES

Verti-Line
CLOSE-COUPLED PUMPS
for every Industrial Vertical Pump Installation



The Verti-Line Close-Coupled Pump is not just another deepwell pump adapted to industrial service. It is designed and engineered for such jobs as booster service, fire protection, cooling, transfer and general service pumping of water and other fluids, corrosive or non-corrosive.

Verti-Line Pumps are made to the highest standards of quality in workmanship and materials to assure a *precision built* product. Each unit is thoroughly tested and rigidly inspected, insuring ease of field assembly and perfect performance—guaranteed to meet the most exacting specifications.

Whatever your vertical pump needs, investigate Verti-Line Pumps before you buy.

CAPACITIES FROM 20 GPM TO 30,000 GPM — HEADS TO 600 PSI

Heavy-Duty Fabricated Discharge Head With Solid Shaft Motor

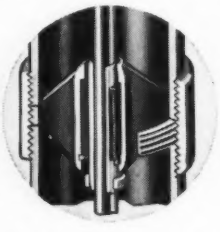
In-Line "T" Type Fabricated Discharge Head With Hollowshaft Motor

Standard Discharge Head With Combination Gear and Motor Drive

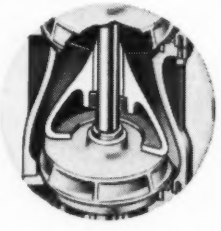
TYPICAL CONSTRUCTION FEATURES

(Open lineshaft type . . . Enclosed lineshaft also available)

The packing assembly is simple and effective. It is easily accessible and consists of a packing container, lantern ring, packing rings, pressure relief bushing, gland, fluid by-pass and lubrication fittings. Mechanical shaft seals also available.



Outstanding feature of bearing assembly is removable stainless steel shaft sleeve. This prevents shaft wear and bearing journal corrosion, and is easily replaced without special tools. You simply remove the old and slip on the new which is secured by a stainless steel collet.



Dual bowl bearings of rubber and bronze are supplied in most open and enclosed lineshaft pumps. Extra stability and resistance to abrasives mean longer life.

Send for your free copy of our new booklet, "Pumps for Sale."
Ask for Bulletin D-66

Verti-Line Pumps are the exclusive products of
LAYNE & BOWLER PUMP COMPANY
general offices and main plant
2943 VAIL AVENUE • LOS ANGELES 22, CALIFORNIA

of all warranties except specifically designated ones, or of all types of warranties.

It is obvious that they should be able to disclaim express warranties, but it is less obvious that they can also disclaim implied warranties. Although the latter arise by operation of law, they are simply intended for the protection of the buyer. If he chooses to bargain away these rights, that is his business.

Disclaimers of express and implied warranties will be given effect by the courts. However, the courts generally give the narrowest possible interpretation of disclaimer clauses, since they usually go unnoticed by the buyer. For example, unless implied warranties are specifically mentioned in the disclaimer clause, the court will assume that only express warranties were intended to be disclaimed.

Parol Evidence of Warranties

There is no difficulty in proving implied warranties, since they arise by operation of law under specified sets of facts. However, it is sometimes difficult to prove express warranties. Frequently the facts are obscure. The parol evidence rule prevents proof of promises that vary the terms of a written agreement, where the writing is intended to be an integration of the entire agreement.

Example Problem

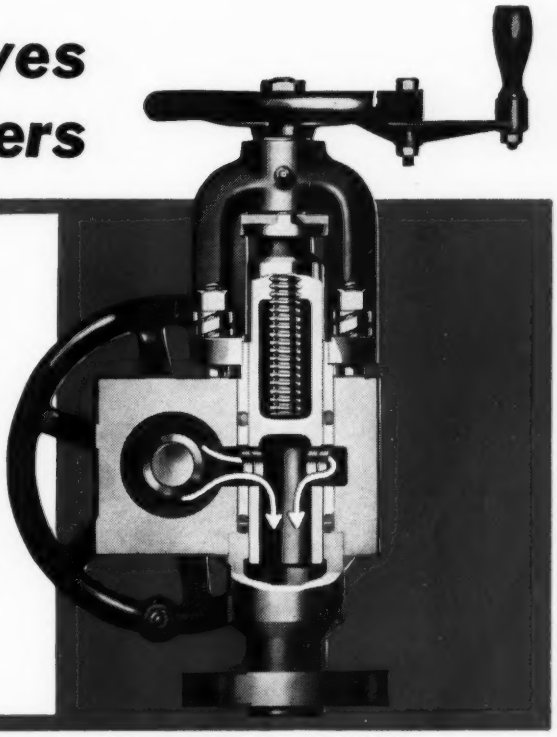
As an example of the problems involved in warranty cases, here is a typical problem, answer to which will be given next month:

A written contract for the sale of specifically designated aluminum sheets stated that the purchaser had examined them. In a suit for breach of warranty, he sought to prove that the aluminum was corroded and unfit for resale to manufacturers of aluminum products, and that although he was given an opportunity to inspect the sheets, he did not do so because they were piled in heavy, high bundles in a warehouse and it would have been difficult to do so.

Is this evidence admissible?

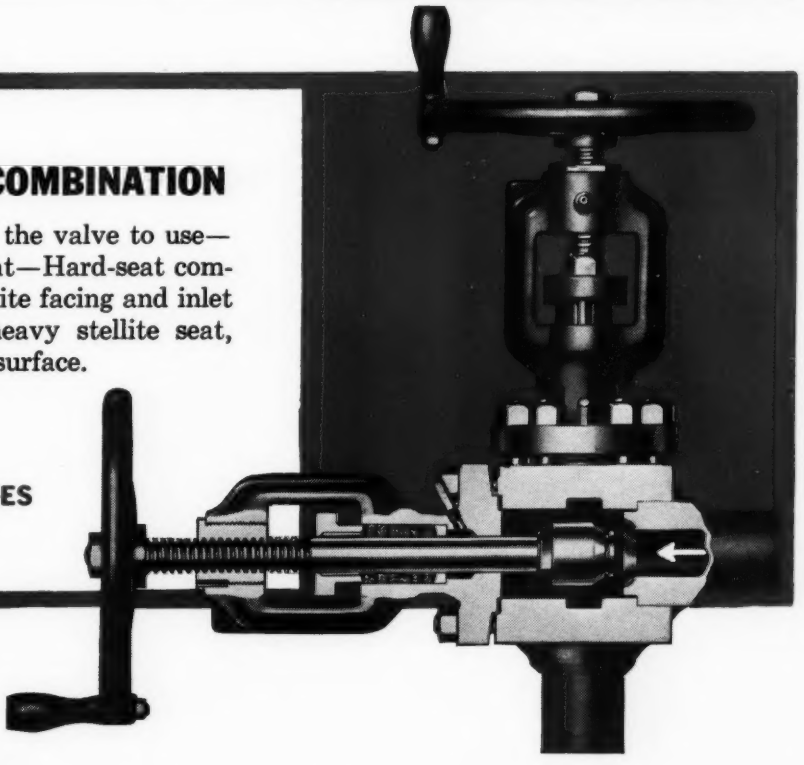
UNIT TANDEM

rugged blow-off valves for high pressure boilers



HARD-SEAT—SEATLESS COMBINATION

■ For boilers up to 1500 psi, this Yarway Unit Tandem Blow-Off Valve offers the maximum in dependable service. A one-piece forged steel block serves as the common body for the Yarway Stellite Hard-seat blowing valve and the Yarway Seatless sealing valve. All interconnecting flanges, bolts and gaskets are eliminated. The Unit Tandem at right is sectioned through Seatless Valve to show balanced sliding plunger in open position and free flow.



HARD-SEAT—HARD-SEAT COMBINATION

■ For boilers to 2500 psi, this is the valve to use—Yarway's Unit Tandem Hard-seat—Hard-seat combination. Disc has welded-in stellite facing and inlet nozzle has integral welded-in heavy stellite seat, providing smooth, hard-wearing surface.

OVER 4 OUT OF 5
HIGH PRESSURE PLANTS
USE YARWAY BLOW-OFF VALVES

Write for Yarway Catalog B-434

YARNALL-WARING COMPANY
106 Mermaid Ave., Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY **BLOW-OFF VALVES**

Specialized Field... Food Facilities Engineering

N. BERT PERSSON

N. Bert Persson, Principal of Food Service Equipment Engineering, St. Paul, Minn., received his degree in mechanical engineering from the University of Minnesota Extension Division in 1936. He became a registered engineer the same year. While working toward his degree, he was employed by Joesting & Schilling Co. as Chief Engineer. He has had his own food facilities consulting business since 1939, except for two years during the war, 1943 to 1945, when he was Senior Equipment Engineer for Northwest Airlines.

THIS EMPLOYEES' CAFETERIA COUNTER IN A STATE INSTITUTION IS DESIGNED FOR FAST SERVICE, EASY MAINTENANCE AND CLEANING.

FOOD FACILITIES engineering, as a specialized field, is relatively new. Although it embraces electrical and mechanical engineering, clients considering a new food service project usually have gone to the equipment salesman for advice and even plans. But, as in all other branches of engineering, it takes a consultant, with a thorough knowledge of the overall problem, to engineer a satisfactory job.

Basic Classifications

The field of food facilities engineering can be divided into three basic classifications: storage, processing, and serving. These may be institutional, commercial, industrial, or private services, none of which is static. People's eating habits change. New methods of handling foods, such as sterilization by radiation, dehydro canning, and microwave cooking, must be considered. All food service operations should be planned to fit the types of service needed and the menus suitable for such services. Plan layouts must not restrict the operator so as to require him to adjust the menus to the facilities.

Rules of thumb, when used by inexperienced planners, can have disappointing results. For example, when determining necessary floor space for a given project, it is not enough to rely on rules that depend on a "square foot" basis. A long narrow kitchen is not only more difficult to lay out but usually is less efficient than a kitchen with 1 to 1½ width-to-length ratio. Two areas of identical over-all floor space and width-to-length ratio may, in one instance, produce a good layout and in another a poor layout. Columns, jogs, stairs, and other interferences make the difference. Some of the more commonly used rules of thumb do not take into consideration such factors as food storage areas, locker rooms for help, and other indirect facilities. It is not always clear to the inexperienced planner which rules are affected by these factors. The tendency is to allow too little floor space for the food facilities.

Consultant's Responsibilities

The food facilities consultant not only does the general planning of a system but also provides technical data on the proper temperature and pressure of water and steam and the volumes required. Gas quantities, electric power requirements, and connection locations for the various items of equipment are equally important design considerations.

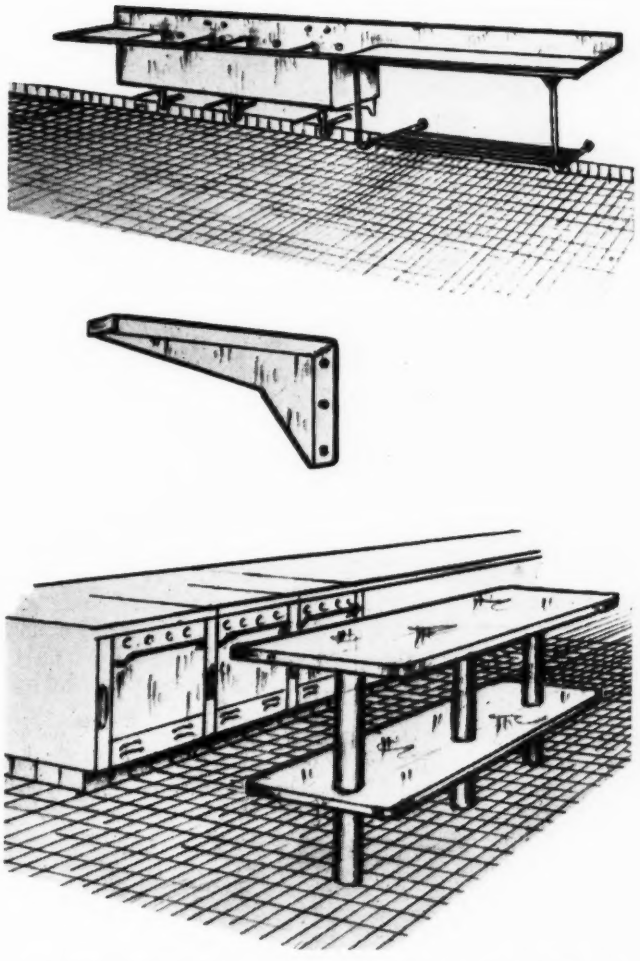
Where should the gas, water, and electric roughing-in locations be placed? Frequently it is advisable to indicate on the technical plan locations of connections on the equipment, rather than the roughing-in locations. This permits the contractor to shift locations to miss reinforcement members and other interferences. What type of range and kettle exhaust should be used? What kind of water conditions are necessary? What kind of processing methods are best suited to the specific foods involved? What are the storage requirements? These questions are the business of the food facilities consultant.

Terminology

The manner in which specifications are written very often results in misunderstandings and extras. Care must be taken to identify equipment by satisfactory names and meaningful descriptive terms.

In a restaurant we refer to a sink. That same item may be called a vat in a dairy plant or a tank in a slaughter plant. However, to some people a kettle is a vat. A fryer has been called a kettle. A standard revolving-deck oven may, or may not, become a roasting oven.

Such terms as "heavy gage stainless steel," "adjustable legs," "coffee urns," and "steam table," will not be interpreted the same way by every manufacturer or contractor. There is a considerable difference between 16 gage and 12 gage stainless steel both as to strength and cost. Some adjustable legs are very objectionable. A hexagon bolt could conceivably be called an adjustment for a leg. "Coffee urns" might mean a battery of urns or any one of several types — or some kind of combination urn. The old "steam table" now is considered more or less obsolete. The modern unit does not even use steam, and no water or drain connections are required.



GOOD DESIGN CLEARS FLOORS OF PLUMBING AND LEGS. SHELF BRACKET HAS NO LEDGE TO COLLECT DIRT AND RANGES ARE MOUNTED ON RECESSED CONCRETE BASES.

FOUR CONVEYOR BELTS ON PEELING AND GRADING TABLE SPEED FRUIT AND VEGETABLE PREPARATION.

On projects where the low bidder, by law, becomes the successful bidder, it is particularly important that the specifications are written clearly and intelligently. Wherever an item has been so described that the estimator figuring the job can interpret it in two ways, he must assume the cheaper interpretation, even though the specifications writer intended and wanted the better equipment. This is an unfortunate situation and unsatisfactory from everyone's viewpoint.

Equipment Connections

Who shall be responsible for the actual connection of the equipment to the roughing-in locations? The plumber and electrician claim that the equipment dealer should. They may ask, "Who else knows better where and what size the connections must be?" The equipment dealer often complains that he cannot get firm bids from his subcontractor and has to guess, resulting in a great loss to him. Recently some of the leading dealers have refused to bid on jobs where they must be responsible for the

Owners May Think the Following Excerpts From a Hypothetical, Poorly Written Specification Covering Food Facilities Will Be Satisfactory.

The following, poorly written specification for a cafeteria counter makes it difficult for the estimator to figure a job within reasonably accurate limits. In instances where the low bidder, by law, is to be awarded the contract, the estimator must choose the cheaper interpretation to present a competitive bid.

"Provide a 40 ft 6 in. long counter as per floor plan. It shall have a full length tray slide. Construct the top of heavy gage stainless steel. Counter front shall be constructed of stainless steel paneling. Equip counter with 6 in. high adjustable feet. Into counter shall be a salad section approximately 4 ft 10 in. long with a 4 ft 0 in. long cold pan. Above cold pan shall be a display shelving unit consisting of two glass shelves supported by square tubular supports.

"The hot-food serving unit shall be approximately 6 ft 0 in. long consisting of five 12 x 20 food-pan frames independently controlled. No water shall be used in unit. Provide cutting board and, above top, a full-length serving shelf with glass food guard in front.

"The bread section shall have a full-length overhead display shelving unit same as for salad section consisting of two shelves . . . etc."

Although these specifications seem reasonably clear, the estimator must decide how to interpret the questionable points outlined below:

But What Will the Estimators' Interpretation Be?

1. Should tray slide be a ribbed solid-type slide or tubular type? Should it be stainless steel? A chrome-plated brass tubing slide could be furnished. Cast iron, chrome-plated brass tubing brackets could be used as the supporting members for the slide.

   The owner is expecting a stainless steel counter but he may have to pay extra to get a stainless steel slide with the above specification.

2. What is meant by "heavy gage"?

   Counter tops should be 14 gage, but since the specs are not definite, the bidder need not furnish 14 gage. It is not mentioned that the glass guard should be up from the counter top to permit air circulation across the glass surface. Without such circulation, steam forms on the glass, obscuring vision.

3. What gage should be used for the front paneling?

   Usually an iron sheet backing is provided for stainless steel facing. But if the facing is of a light gage it will buckle. Either a heavy gage sheet must be used or the lighter sheet ribbed.

4. What kind of cold pan is wanted? Is it to be cooled by ice or by mechanical refrigeration? How deep should it be?

   Should counter top be insulated from pan by a breaker strip to prevent condensation?

   How much and what kind of insulation should be used? The pan has not been specified as being insulated. So what should the owner expect?

   Should a cold-plate type of coil be used or should copper tubing be soldered to underside of pan?

   Should cold pan liner be stainless steel or galvanized iron? If galvanized iron is furnished, the owner will pay extra for stainless.

   How wide must pan be? A narrow one costs less.

   This is a typical example of poor specification writing. Even if mechanical refrigeration were considered by the estimator, what size tubing would he use and how many lineal feet? What about the expansion valve? Who will furnish it and what capacity should it have? If the cold pan does not work properly, who is to blame — the equipment dealer or the refrigeration contractor? An extra must be paid by someone.

5. Should display shelving be ¼ in. plate glass or double strength glass? Should salads placed on top shelf have a glass food protector over them? Does owner expect sloping sneeze guards for each shelf?

   As the specs are written, the dealer cannot be compelled to furnish food and sneeze guards unless local laws call for such equipment. Chances are this will be another extra. Nothing has been said as to how high the shelves are from counter top. Clearance between shelves may not be sufficient if lighting fixtures are provided. Since the bread section is to be a duplicate of the salad section, whatever mistakes are made on one will be made on the other.

6. How should the five food pan frames be controlled?

   Since the specs do not call for automatic controls, unit will have only regular controls. If the help is not alert, food may be overcooked.

7. Should a storage compartment be provided or does the owner wish dish storage carts? Is storage space to be enclosed?

   The estimator may bid on a unit without any enclosure, shelf, or carts.

8. Nothing was said about sealing cracks between the various units in the counter.

   Unsealed cracks allow food and liquids to accumulate in spots difficult or impossible to clean.

9. How should the hot food serving unit be heated?

   Usually at this phase of a project the estimator has no technical plans to refer to that would determine whether gas or electric is to be used. If estimator decides on gas and later discovers that electricity must be used, the owner will find himself paying still another extra.

10. What type of carving board should be provided?

    A strip top board will remain flat, while a solid board may curl with use, causing dirt cracks. What kind of wood should be used. Is it possible that the owner expects a stainless extension of the top with a portable cutting board? If a full length board is furnished, will it be spaced away from the unit top to facilitate cleaning?

connections of equipment. Correctly worded specifications and technical plans can minimize such critical problems.

How much meaning does the phrase "or equal" have to different contractors? One manufacturer's item may have two electric motors totaling more horsepower than a competitor's item using only one electric motor, yet the rated capacities of the equipment are the same. One manufacturer may base his capacity on 100 percent efficiency and another on 70 percent efficiency. This is not always clearly stated in the manufacturer's literature. Some electric equipment comes complete with electric starters, some does not; specs must clarify such discrepancies.

Today's sanitation requirements are more specific than they have ever been in the history of the food industry. Some equipment manufacturers have rebuilt their entire manufacturing facilities to comply with the newer standards. Others have not.

NSF Standards

In 1948 the National Sanitation Foundation published a report that has become the "bible" of the food facilities industry. Prior to that time there existed conflicting opinions as to what should be acceptable from a sanitation engineer's viewpoint. Manufacturers of food service equipment found it difficult to standardize their equipment. Some localities in our country would reject equipment that was acceptable to others. This report, along with more recent publications by the Foundation, has gone a long way toward improving and simplifying these problems.

The idea of using NSF labels of approval on equipment used in connection with food handling is a rather recent method of determining which equipment meets the standards. Not all first class equipment has such labels on it. It may take some time yet before that becomes an actuality.

Current Trends

There are certain sanitation ideas that do not involve the equipment itself but are closely related. One is a trend toward using food service equipment that is wall-supported, eliminating floor legs. Such installations permit better housekeeping and cut down overhead costs.

Another trend is to specify roughing-in locations in the walls wherever this is possible. The fewer legs, pipes, conduits, and other obstructions contacting the floor, the better will be the results. The slightly higher cost will be offset by reduced maintenance and improved sanitary conditions.

Mechanical and electrical facilities are being planned to eliminate exposed overhead pipes, conduits, and ducts over food storage, processing, and serving areas.

Smaller equipment such as toasters, griddles, and fryers should not be connected permanently to wall or floor outlets but should be provided with plugs to permit the equipment to be moved.

Garbage disposal systems should be planned carefully to prevent stoppage in the sewer system. Will the municipal sewer system handle treated garbage? Possibly disposal units must not be used.

Specialized Field

The factors discussed are just a few of the many interesting and challenging problems facing the professional food facilities consultant. A specialized consultant has a greater chance to study and cope with the problems of this particular area of engineering. Because the field is relatively new, there is little literature on the subject. The engineer interested in this type of work must learn by "doing."

In May, 1955, a group of consultants engaged in food facilities engineering formed a national society to promote research and improve design of public food facilities. Their services include research, planning, technical guidance and advice to the client, and cooperation with other building planning engineers. Known as the Food Facilities Engineering Society, the group limits its membership to engineers with ten years experience in the food facilities field and one year as an engineer in private practice. No one affiliated with an equipment dealer or contractor is eligible. The members are pledged to observe a code of professional conduct and practice, insuring clients that they are dealing with professional consultants of integrity, experience, business responsibility, and judgment. The Society, which held its first annual meeting in Chicago last month, is working toward recognition of the food facilities engineering field as a profession. ▲▲

IN DISHWASHING DEPARTMENT LEGS ARE OF SANITARY TYPE WITH ADJUSTMENT SHANK ON INSIDE OF PIPE.

PAUL ROGERS
Paul Rogers & Associates

Latest Revisions Bring Major Changes in the

A.C.I. Building Code Requirements

CE exclusive

ORIGINALLY, concrete designers were like artisans who proved their skill through individual endeavor. They were not governed by many rules or specifications. Gradually, it became obvious that basic code requirements or regulations were desirable, and municipalities adopted codes for reinforced concrete construction. The various approaches to this problem resulted in numerous codes without much coordination, and it became increasingly urgent to have a national organization prepare a code, which could be adopted by everyone concerned, with minor variations where local conditions would warrant.

The American Concrete Institute's Building Code, in use for many decades, now generally is adopted by all authorities with power to regulate reinforced concrete construction. This A. C. I. Code has been revised at intervals of every four or five years. The latest revision brings about such major changes that an understanding of it is advisable. This revision has been prepared by a committee composed of 40 engineers and educators under the expert guidance of Dean Frank Kerekes, who recently was elected to the presidency of the American Concrete Institute.

A brief description of these changes is presented here. The reader's attention is called to the published report on these revisions, which appeared in the December, 1955, issue of the *Journal of the American Concrete Institute*, and the amendments of the Philadelphia Convention of the Institute, in February, 1956. The revised Code probably will be published in an early issue of the *Journal*.

Materials and Tests

Revisions in Chapters 1, 2, and 3 deal mostly with materials and tests. The test loading of structures has been liberalized to a certain extent, and more severe rules have been set up for the maximum allowable deflection under such test loads.

As far as the permissible water-cement ratio is concerned, air-entrained concrete, as apart from customary concrete, has been given special attention. Tables have been set up for the maximum water per sack of cement that can be used to obtain the specified minimum compressive strength at 28 days.

There has been a revision in the allowable unit stresses in concrete, giving recognition to the fact that concrete of high strength is now usually available through commercial channels. Whereas the flexural strength of concrete increases with higher crushing strength, it is felt that the shearing strength (as a measure of diagonal tension) does not increase

proportionally. For beams with no web reinforcement, therefore, a maximum allowable shearing unit stress of 90 psi has been specified. Similarly, for beams with either stirrups or bent bars (but not both), an upper limit of 240 psi now is specified.

Embedded Pipe and Conduit

Chapter 4 has only small changes concerning the mixing of concrete and cold weather requirements, but Chapter 5 contains major changes relative to conduits and pipes, embedded in concrete. This is a result of the realization that radiant heating pipes and electric conduits have been embedded in concrete slabs on many modern projects. To standardize such installations and safeguard against the impairment of the strength of concrete, definite rules now govern the size, location, and testing of these pipes, and maximum limits specify the temperature and pressure to which this piping may be subjected.

Chapter 5 also expresses, in explicit form, the requirements for splices in reinforcement, providing for a minimum overlap of 24 bar diameters — but not less than 12 inches.

Ultimate Strength Method

One of the most important and revolutionary changes in this new Code appears in Chapter 6. Although it is expressed in less than two lines, it is bound to change the procedure of reinforced concrete design for years to come. This major change is as follows:

The ultimate strength method of design may be used for the design of reinforced concrete members.

Flexural computations of reinforced concrete have been based, for the last several decades, on the elastic, or straight-line, theory. Originally, the early developers of reinforced concrete, cognizant of the inelastic properties of concrete, made use of the plastic, or ultimate, theory. Although their basic philosophy was correct, the elastic theory later was adopted universally because of its mathematical simplicity, and because of the recommendations of noted authorities of the time (about the turn of the century).

For quite some time it has been recognized that the elastic, or straight-line, theory does not give a true presentation of the ability of reinforced concrete members to sustain loads. In fact, various amendments to the Code (such as those having to do with the design of columns and of beams with compressive reinforcement) were based on this ultimate theory.

In order to assist designers, the new Code refers, in a footnote, to the Joint A.S.C.E.-A.C.I. Report on Ultimate Strength Design.

It is not expected that concrete designers will forego their previous experience with the straight-line theory and adopt the ultimate design within a short period. But engineers with foresight and interest in improving our present-day methods undoubtedly will put the ultimate design method in practical use so that within a reasonable time enough experience will be gained for the tabulation of design data for every-day use.

Flexural Computations

Chapter 7, which deals with flexural computations, presents certain changes of coefficients for simplified design — with particular emphasis on the end span of continuous girders. An important revision to this chapter is contained in the statement that, "The effect of haunches shall be considered both in determining bending moments and in computing unit stresses." It was felt that the knowledge of design by continuity has become so universal that there no longer can be any excuse for ignoring variable moments of inertia of flexural members.

This chapter also explains the reason for allowing an increased value for the compression reinforcement in beams. Concerning shrinkage and tempera-

PAUL ROGERS

Paul Rogers, senior member of Paul Rogers & Associates, received his education as a graduate engineer of civil construction at Ecole du Genie Civil, Paris, France. He also has had graduate study at Illinois Institute of Technology since coming to the United States in 1939, and has served as assistant professor at Chicago Technical College and lecturer at both the Northwestern University Graduate School and Illinois Institute of Technology. As a result of his professional activities as a registered engineer in numerous states, he received the J. James R. Croes Medal from the American Society of Civil Engineers, in 1953, and awards from the Western Society of Engineers in 1950 and 1954.

Rogers is the author of the textbook, "Tables and Formulas for Fixed End Moments," Frederick Ungar Publishing Co., 1953, and of the section on miscellaneous concrete structures in the forthcoming edition of the "American Civil Engineers Handbook," John Wiley and Sons, Inc. He also has prepared many articles for Society Journals and technical publications. He is a member of the American Society of Civil Engineers, American Concrete Institute, Western Society of Engineers, Societe des Ingenieurs Civils de France, International Association for Bridge & Structural Engineering, and American Railway Engineering Association, and actively serves on the A.C.I. Standard Building Code Committee 318 and as secretary of the Illinois Section of A.S.C.E. for the 1956-57 administrative year.

ture reinforcement, the minimum percentages now have been made a function of the total cross-sectional area bt_1 as against bd (b = width in inches; t_1 = depth in inches; d = distance from reinforcing to top fiber) of the previous Code.

Shear and Diagonal Tension

There are major changes in Chapter 8. Considerable publicity has been given lately to certain failures of rigid frame structures where the collapse evidently was due to excessive shear stresses as a measure of diagonal tension. Although none of these structures involved a monolithically cast slab, with its recognized advantages, it was suggested that a considerable reduction be made in the allowable shearing stresses to be taken by the concrete alone. The Committee decided, however, that the present Code requirements were satisfactory with only minor changes. They took into consideration the tens of thousands of monolithically cast structures built under the present Code that have performed satisfactorily. On the other hand, the web reinforcement requirements for continuous beams or frames without integral monolithically cast slabs have been tightened considerably. Such web reinforcement now must be designed to carry at least two thirds of the total shear at the section.

As a general rule, "Where web reinforcement is required, the amount used shall be not less than 0.15 percent of the area computed as the product of the width of the member at middepth and the horizontal spacing of the web reinforcement."

Bond Stresses and Anchorage

Computations covering bond stresses and anchorage requirements have been strengthened and emphasized in more explicit terms in Chapter 9. It is expected that within the next few years, both the theory of shear and of bond will undergo major changes, and any such new or revised theories will be presented in the future amendments or revisions to the current Code.

Flat Slabs

Chapter 10 deals with flat slabs with square or rectangular panels, and it has been rewritten in entirety. One of the major changes is the establishment of certain upper limits for the allowable shearing unit stress. Slabs with paneled ceilings now may be considered as flat slabs, provided the panel of reduced thickness lies entirely within the area of intercepting middle strips.

The location of the critical section for negative bending, which in the previous Code was a function of the span length, is now a function of the column or support dimensions alone. A new table provides panel moments for designs based on elastic analysis, and proper percentages are given for panel moments for column strips and middle strips.

Design procedures using empirical methods also have been revised thoroughly with new formulas presented for the required moments of inertia for the column section, slab thickness, and for the numerical sum of the positive and average negative bending moments, which is expressed by:

$$M_O = 0.09\ WLF\left(1 - \frac{2c}{3L}\right)^2$$

where W = total panel load, kips; L = span length in feet; c = effective support size in feet.

Setting the coefficient F = (1.15 — c/L) recognizes the empirical knowledge that for flat plate construction, the sum of moments should be increased.

New tables for the distribution of moments for the empirical method also are presented, and additional tables specify the minimum length of negative and positive reinforcements.

Columns and Walls

Chapter 11, which deals with reinforced concrete columns and walls, also has been revised. The procedure of design and investigation in the previous Code was found cumbersome and often misinterpreted. The new provisions are similar to those of the structural steel specifications, prescribing that $f_a/F_a + f_b/F_b$ (f_a = actual axial unit stress, psi; F_a = allowable axial unit stress, psi; f_b = actual bending unit stress, psi; F_b = allowable bending unit stress, psi) must not exceed unity. Furthermore, the maximum eccentricity now is limited to an e/t no greater than two thirds. If this eccentricity is exceeded, the column is to be designed as a doubly reinforced beam, subject to flexural and axial load using the straight-line theory.

Design formulas for steel pipe columns filled with concrete have been revised so as not to penalize the use of such construction.

The minimum thickness of panel walls has been reduced from 5-in. to 4-in., and the minimum column dimension has been reduced from 10-in. to 8-in., provided the minimum gross area of 120 sq in. is maintained. The minimum temperature reinforcement, in the vertical direction only, has been reduced from .0025 to .0015 bt, in sq in., recognizing that the weight of the wall diminishes the possibility of horizontal cracks in walls due to temperature change.

Footings, Foundations, Precast Concrete

There has been no change in Chapter 12, which pertains to footings and foundations. However, Chapter 14 is a new addition to the Code, providing for minimum requirements for precast concrete.

It is believed that through the adoption and use of the new A.C.I. Building Code, 318-56, the procedure for both design and investigation of reinforced concrete construction has been improved considerably. This should provide an added stimulus for the use of this important method of construction. ▲▲

R. A. ZIMMERMAN
Distribution Engineer
Westinghouse Electric Corporation

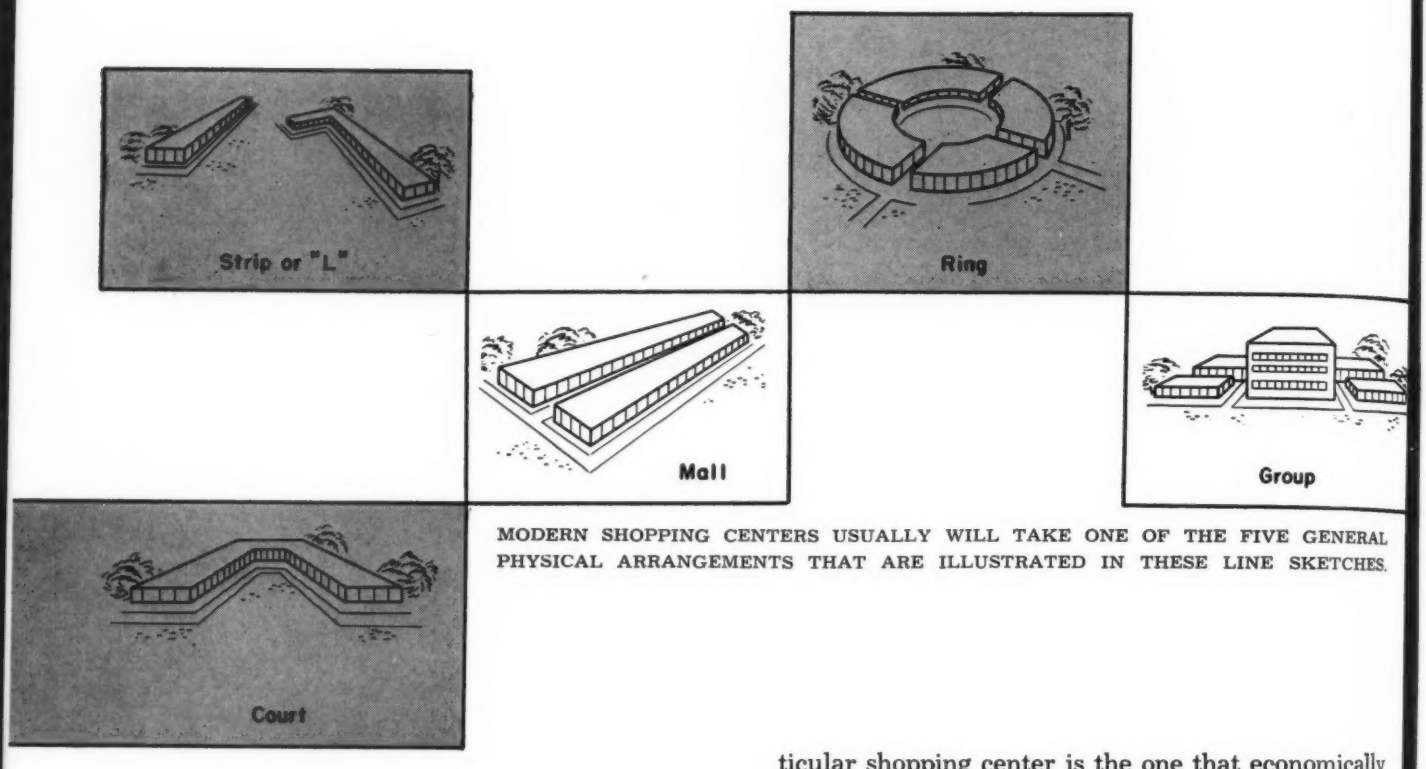
Selection Guide For Consulting Engineers

Electrical Distribution System Planning for Shopping Centers

Robert A. Zimmerman received his B. S. in E. E. Degree from Purdue University, in 1949. Since then he has been affiliated with the Electric Utility Engineering Section of the Industry Engineering Department of Westinghouse Electric Corp. In his capacity as a Distribution Engineer, he has been chiefly concerned with system design, fault studies, and load studies for commercial buildings, industrial plants, and electric utility distribution systems. He also is active in AIEE work, and at present is a member of a national committee, subcommittee, and several working groups.

Zimmerman has authored a number of articles for various technical publications, and several of his papers have appeared in AIEE Transactions, the two most recent being on the use of 265/460Y-volt distribution in commercial buildings and residential areas. This comprehensive discussion provides valuable information on another timely and important topic that is receiving prominent attention—the factors to consider when designing the electrical distribution system for a modern shopping center.

the architects collaborative
ketchum, gina & sharp



MODERN SHOPPING CENTERS USUALLY WILL TAKE ONE OF THE FIVE GENERAL PHYSICAL ARRANGEMENTS THAT ARE ILLUSTRATED IN THESE LINE SKETCHES.

DISTRIBUTION SYSTEMS for shopping centers may take many forms. There is no one distribution system that is best for all shopping centers. This is because the factors that influence system design vary over a wide range from one shopping center to another. The correct distribution system for any particular shopping center is the one that economically provides the quality of service required by the loads.

Simple-Radial System

Most of the shopping centers of today use some form of simple-radial distribution system. Fig. 1 shows the conventional simple-radial system serving a relatively small "strip-type" neighborhood shopping center.

Conventional Simple-Radial System

The system in Fig. 1 uses a single substation where power is received at the supply voltage and is stepped down to the utilization voltage. Low-voltage feeders are run to the stores from the substation. Each feeder is connected to the substation bus through a low-voltage circuit breaker. Power is distributed in the stores through panelboards to the lights, motors, and other loads.

Since the entire load of the shopping center is fed through a single substation and from a single low-voltage bus, full advantage is taken of the diversity among the loads. This permits the use of a minimum amount of transformer capacity in the system. But, because all power is distributed at utilization voltage from a single point, the system voltage regulation and efficiency are poor. The cost of the low-voltage feeder circuits, and their associated circuit breakers, are excessive except where the distances are short and the total load in the shopping center is about 1000 kva or less.

A fault in the substation transformer or on the substation bus will interrupt service to all stores in the shopping center. A fault on any low-voltage feeder circuit will cause an outage to all loads in the store or stores served by that feeder. When a fault

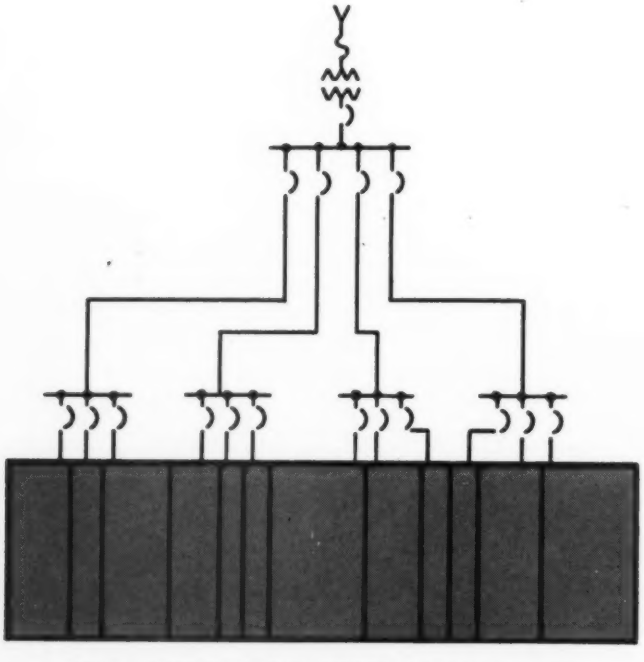


FIG. 1—CONVENTIONAL SIMPLE-RADIAL SYSTEM SERVING SMALL STRIP-TYPE SHOPPING CENTER.

occurs, service cannot be restored until the fault has been located and corrected.

Modern Simple-Radial System (a)

The modern simple-radial system shown in Fig. 2 overcomes many of the objections of the conventional simple-radial system. It distributes power to several load centers in the shopping center at distribution voltage rather than at the lower utilization voltage. At each of these load centers there is a small secondary substation. These substations usually are completely factory-built unit substations known as power centers. Each power center consists of a three-phase liquid or dry-type transformer with an integrally-mounted primary disconnect switch and drawout-type, low-voltage, metalclad switchgear. The transformer and switchgear are connected together to form the completed unit substation.

Since a transformer is located at each load center, each transformer must have sufficient capacity to carry the peak load of the store or stores served from its low-voltage bus. This means that more transformer capacity is required than in the conventional simple-radial system. However, because power is distributed to the load centers at distribution voltage, system losses are reduced, voltage regulation is improved, there is a marked saving in feeder circuit copper, and the large, low-voltage feeder breakers are eliminated. Also the interrupting duty imposed on the low-voltage feeder breakers is more uniform, and, at many of the power centers, may be less than when using the system with one large substation.

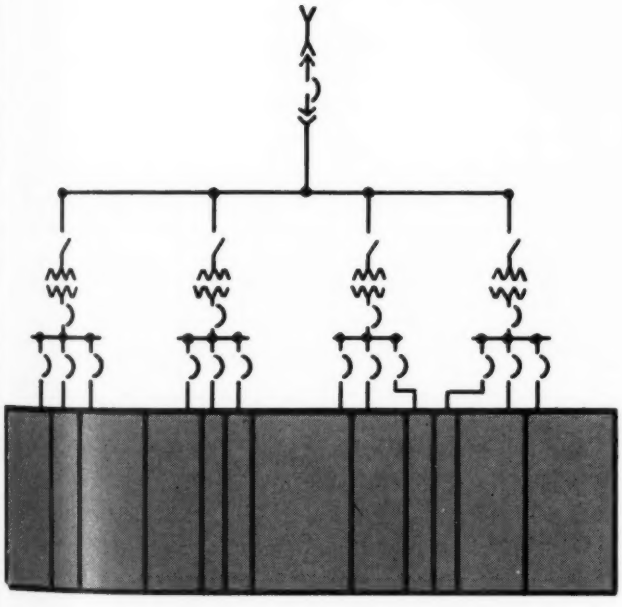


FIG. 2—MODERN SIMPLE-RADIAL SYSTEM (a) SERVING SMALL STRIP-TYPE SHOPPING CENTER.

This system usually will be lower in initial investment than any other type of distribution system for shopping centers having a load above about 1000 kva. However, the system is very poor from the standpoints of flexibility and service continuity, for in order to keep the system investment low, all power centers are connected to the one primary feeder. In a shopping center served by only one primary feeder, a feeder fault will cause an outage to the entire shopping center.

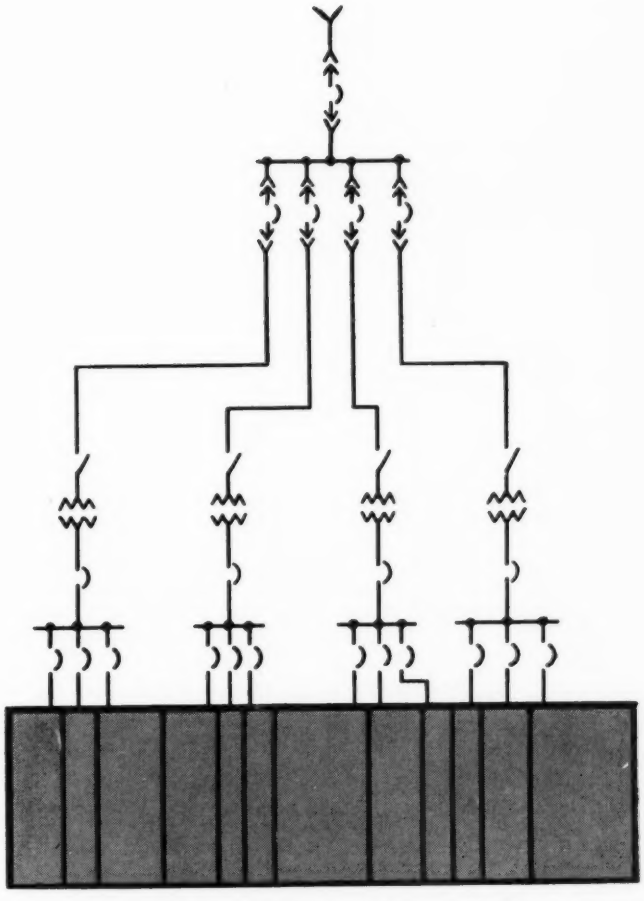


FIG. 3—MODERN SIMPLE-RADIAL SYSTEM (b) SERVING SMALL STRIP-TYPE SHOPPING CENTER.

Modern Simple-Radial System (b)

The variation of the modern simple-radial system shown in Fig. 3 provides improved flexibility and service continuity by reducing the number of transformers connected to each feeder. This increases the number of primary feeders and feeder breakers in the system and consequently increases the system investment. However, the extent of outage resulting from a primary feeder or transformer fault is reduced. If the number of primary feeders is increased to the point where there is only one transformer per feeder, the system is comparable in service continuity to the single-substation form of simple-radial system. Such a system arrangement, using an individual feeder and automatic feeder breaker with each transformer, usually will be very expensive. The cost of such a system can be reduced materially by replacing the automatic feeder breaker with

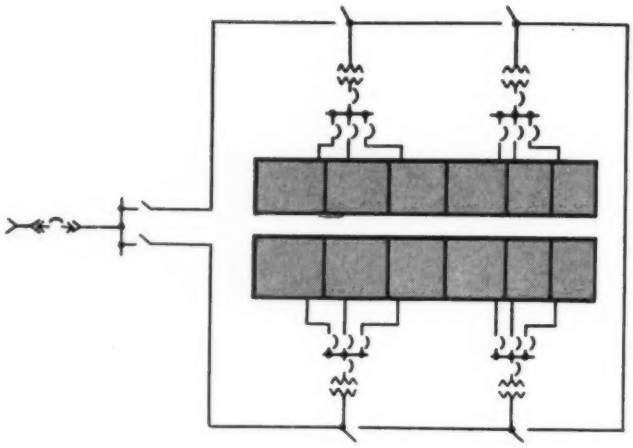


FIG. 4—LOOP-PRIMARY RADIAL SYSTEM SERVING A TYPICAL SHOPPING CENTER OF THE MALL TYPE.

manually-operated breakers or load-break switches, and backing up a number of these switches with one automatic feeder breaker, as shown in Fig. 3.

In this form of simple-radial system, a primary feeder or transformer fault causes an outage to the entire shopping center. However, service can be restored quickly to all loads, except those normally fed through the faulty feeder or transformer, by opening the load-break switch associated with the fault. Service cannot be restored to the loads associated with the faulty portion of the system until the fault is eliminated.

Loop-Primary Radial System

The loop-primary radial system (Fig. 4) provides for quick restoration of service when a primary feeder or transformer fault occurs—and at a lower system investment than the simple-radial system. A sectionalized primary loop controlled by a single automatic primary feeder breaker is used rather than a straight radial primary feeder or feeders.

The manually-operated load-break switches installed in the feeder permit any transformer, and its associated section of loop, to be disconnected from the rest of the system should they become faulted. When a transformer or primary feeder fault occurs, the main breaker opens and interrupts service to the entire shopping center. As soon as the fault is located, the faulty section of the loop and its associated transformer can be disconnected from the system by means of the load-break switches. Service then can be restored quickly to all but the isolated portion of the system by closing the primary feeder breaker. Service cannot be restored to the stores served by the transformer or primary loop section that is faulted until repairs are made.

The cost of this system is only slightly higher than the cost of the modern simple-radial system shown in Fig. 2. The primary circuit cost is a little greater, and there are two additional load-break switches in the system, one on each side of the primary feeder breaker. The load-break switches, associated with the transformers, will cost little more than the disconnecting switches in the primary leads of the transformers in the simple-radial systems.

Banked-Secondary Radial System

The banked-secondary radial system permits quick restoration of service to all stores following a primary feeder or transformer fault. The system uses a secondary loop, as shown in Fig. 5, to provide an emergency supply when a transformer or primary cable section fails. The primary circuit arrangement in this system is the same as that in the loop-primary radial system of Fig. 4. The primary feeder arrangement of the simple-radial system of Fig. 3 can be used to give the same results, but usually is more costly.

A primary feeder or transformer fault interrupts service to all loads. However, service can be restored quickly, after locating the fault, by opening the two load-break switches and one transformer breaker associated with the fault and then closing the primary feeder breaker. The stores connected to the low-voltage bus associated with the disconnected transformer are served over the secondary loop from the adjacent load busses.

The secondary loop gives a number of important advantages in addition to providing quick restoration of service to all loads. It helps to equalize the loading on all transformers. This makes it unnecessary to carefully match the transformer capacity in each power center to the load connected to each load bus. This matter of matching transformer capacity with the load at each load bus is a real problem in all other radial systems, with the exception of the conventional simple-radial system shown in Fig. 1. The secondary loop permits the use of one transformer rating throughout the system. It also permits circuits to be run directly from the nearest load bus to the stores. This makes it possible to reduce the length and cost of secondary circuits in the system.

Since the transformers are connected in parallel and take advantage of the diversity among the loads,

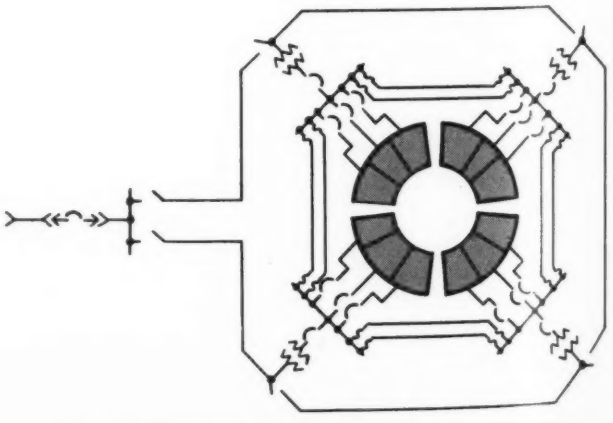


FIG. 5—BANKED-SECONDARY RADIAL SYSTEM FOR A TYPICAL SHOPPING CENTER OF THE RING TYPE.

there is usually a saving in transformer capacity over any other form of the radial system—except the simple-radial system of Fig. 1. The banked-secondary system is better adapted for across-the-line starting of relatively large motors because the starting current is supplied through several transformers in parallel rather than through a single transformer.

In the banked-secondary radial system, fault current not only flows through the transformer associated with the faulty low-voltage bus or load circuit, but it also flows through other transformers and over the secondary loop to the fault. This results in increased short-circuit current, which may be sufficient to require the use of load circuit breakers having a higher current interrupting rating than those required in other types of modern-radial systems. This is a possible cost increase that may or may not be offset by reduced transformer capacity and secondary circuits.

It is difficult to make a general cost comparison between this system and the loop-primary radial system. In some shopping centers, the additional cost of the secondary loop will be offset. In others, because of lack of diversity among the loads and a relatively uniform distribution of load, the savings are very small and the system will cost more than the loop-primary radial system to the extent of the cost of the secondary loop. However, the advantages of quick restoration of service to all loads, greater flexibility, higher efficiency, and better voltage conditions may justify the additional cost.

Primary-Selective Radial System

The primary-selective radial system uses at least two primary feeder circuits in each load area. The system is designed so that when one primary feeder is out of service, the remaining feeder or feeders have sufficient capacity to carry the total load. While three or more primary feeders may be used, the usual arrangement is to use two feeders as shown in Fig. 6. Half of the transformers normally are connected to each of the two feeders. Thus, when a fault occurs on one primary feeder, only half of the load in the shopping center is dropped. Double-throw or primary-selector switches are used with all transformers so that when a primary fault occurs, the transformers normally supplied from the faulty feeder can be switched to the good feeder, quickly restoring service to all loads.

If a fault occurs in one of the transformers, its associated primary feeder breaker opens and interrupts service to half of the load. The faulty transformer is disconnected from the system by moving its primary selector switch to the open position. Service then is restored (to all stores except those normally supplied by the defective transformer) by reclosing the open primary feeder. The stores normally supplied by the defective transformer will have a service outage until it can be repaired or replaced.

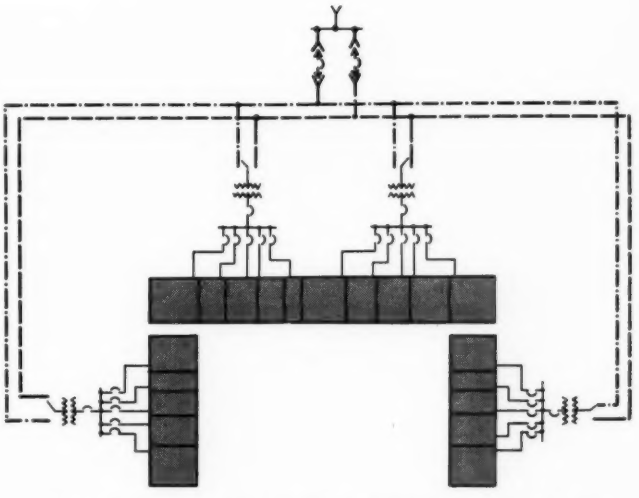


FIG. 6—PRIMARY-SELECTIVE RADIAL SYSTEM FOR TYPICAL SHOPPING CENTER OF THE COURT TYPE.

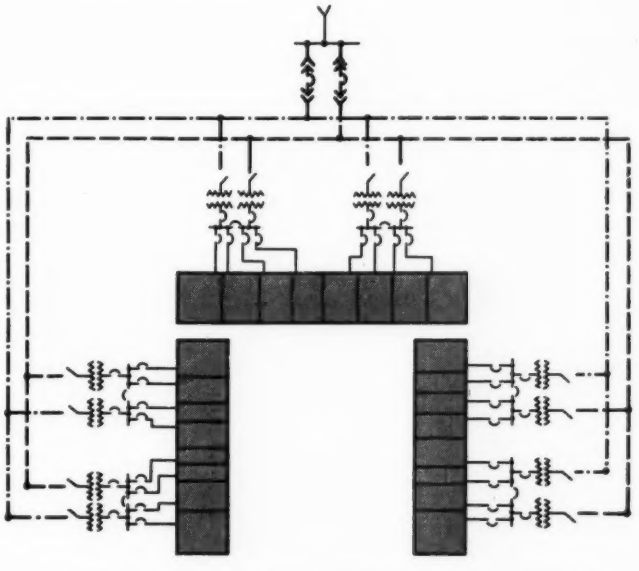


FIG. 7—SECONDARY-SELECTIVE RADIAL SYSTEM (a) SERVING TYPICAL COURT-TYPE SHOPPING CENTER.

The cost of the primary-selective radial system is greater than the cost of the modern simple-radial system of Fig. 2 because of the additional primary feeder breaker, the use of a primary selector switch at each transformer, and the greater amount of primary feeder cable required. The benefits that come from the reduction in the amount of load dropped when a primary feeder or transformer fault occurs, plus the quick restoration of service to all or most of the loads may more than offset the greater cost. The primary-selective radial system, however, is not as good as the banked-secondary radial system for restoring service to the loads after a primary or transformer fault. It is only a little better than the loop-primary radial system in this respect.

Secondary-Selective Radial System (a)

The secondary-selective radial system uses the same principle of duplicate feed from the power sup-

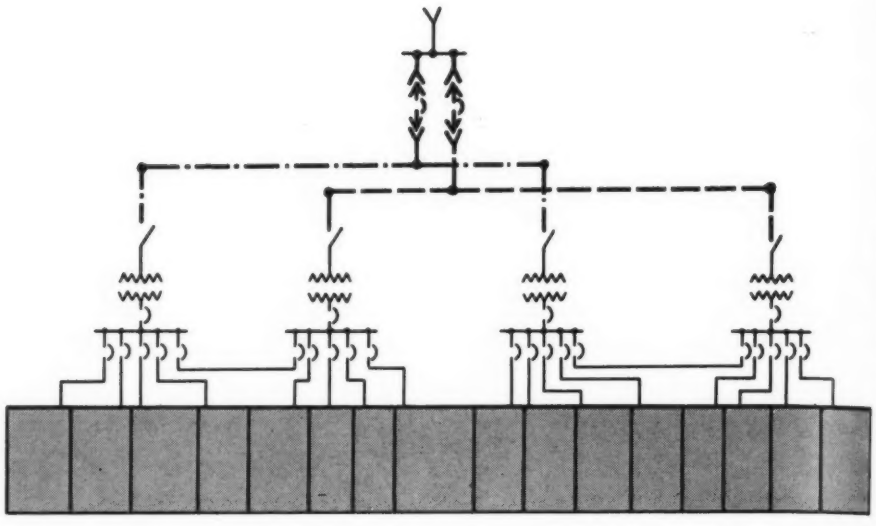


FIG. 8—SECONDARY-SELECTIVE RADIAL SYSTEM (b) SERVING STRIP-TYPE SHOPPING CENTER.

ply point as the primary-selective radial system. However, in this system the duplication is carried all the way to each load bus on the secondary side of the transformers instead of just to the primary side of the transformers. This arrangement permits quick restoration of service to all loads when a primary feeder or transformer fault occurs, as does the banked-secondary radial system.

The usual form of secondary-selective radial system is shown in Fig. 7. Each load area is supplied over the two primary feeders and through two transformers. The capacity of each transformer must be sufficient to carry the entire load connected to the low-voltage bus. Each transformer is connected through a transformer breaker to a secondary bus section. Half of the radial load circuits are connected to this bus section. A bus-tie breaker is provided for connecting the two secondary bus sections together. Normally, this bus-tie breaker is open, and the system operates as two parallel systems entirely independent of each other beyond the power supply point. The bus-tie breaker is interlocked with the two transformer breakers in each power center so that it cannot be closed unless one of the transformer breakers is open. This keeps the short-circuit current interrupting duty on the load circuit breakers to a minimum.

A primary feeder fault causes an outage to half of the stores just as in the primary-selective radial system. Service can be restored quickly by opening the transformer breakers associated with the faulty feeder and closing the bus-tie breakers at all power centers. When this is done, the entire load in the shopping center is supplied over one primary feeder and through half of the transformers. In addition to the fact that each primary feeder must be capable of carrying the entire load, just as in the primary-selective radial system, much more transformer capacity is required.

A fault on one transformer causes the associated primary feeder breaker to trip and interrupt service to half of the stores. Service is restored by opening the disconnecting switch in the primary leads, opening the breaker in the secondary leads of the faulty transformer, closing the associated bus-tie breaker, and reclosing the associated primary feeder breaker. This manual switching restores the system to the normal operating condition, except that the faulty transformer is de-energized. Its load is supplied through the other transformer in that power center.

The cost of the secondary-selective radial system usually will be considerably more than that of radial systems previously described, with the exception of the simple-radial system of Fig. 1 and the banked-secondary radial system of Fig. 5. This is chiefly due to the large amount of transformer capacity required to provide duplicate power supply to the load busses. Because of this spare transformer capacity, the voltage regulation provided by the secondary-selective radial system, under normal conditions, is better than the others described, with the possible exception of the banked-secondary radial system. From the standpoint of voltage fluctuation due to motor inrush current this system is not as good as the banked-secondary radial system.

The advantage that the secondary-selective radial system offers over the banked-secondary radial system is that a primary feeder or transformer fault interrupts service to only one-half the load instead of all the load. Both of these systems permit quick restoration of service to all loads when a primary feeder or transformer fault occurs. The banked-secondary radial system can be adapted more readily to changing load conditions than can the secondary-selective radial system.

Secondary-Selective Radial System (b)

Another form of the secondary-selective radial system is shown in Fig. 8. This arrangement can be less costly. In this system there is only one transformer at each load bus instead of two. Pairs of adjacent load busses are connected with secondary

cables or bus duct capable of carrying the total load of either bus. This is done to permit picking up the stores on any load bus if an associated primary feeder or transformer fails. Each tie circuit is connected to each of its two load busses through a tie-circuit breaker. Each tie breaker is interlocked so that it cannot be closed unless one of the two transformer breakers is in the open position.

There are two ways in which this single-transformer-substation form of secondary-selective radial system can be handled. One way is to use the same number and size of transformers as in the usual form of the system. Since there is only one transformer per load center, this means that the loads are divided into twice as many load centers —with half as much load at each. This arrangement has the advantage of reducing the average length of the radial load circuits and the cost of the secondary copper in the system. When compared with other systems, both this and the usual form of secondary-selective radial system introduce the problem of balancing loads on twice the number of load busses.

The other way in which the single-transformer-substation form can be handled is to use the same number of load centers as when employing two transformers per load center. With one transformer of twice the kva rating at each load center, the result is half the number of transformers but the same total transformer capacity. Because of the smaller number of transformers of larger rating, this often will be the lowest cost arrangement of a secondary-selective radial system.

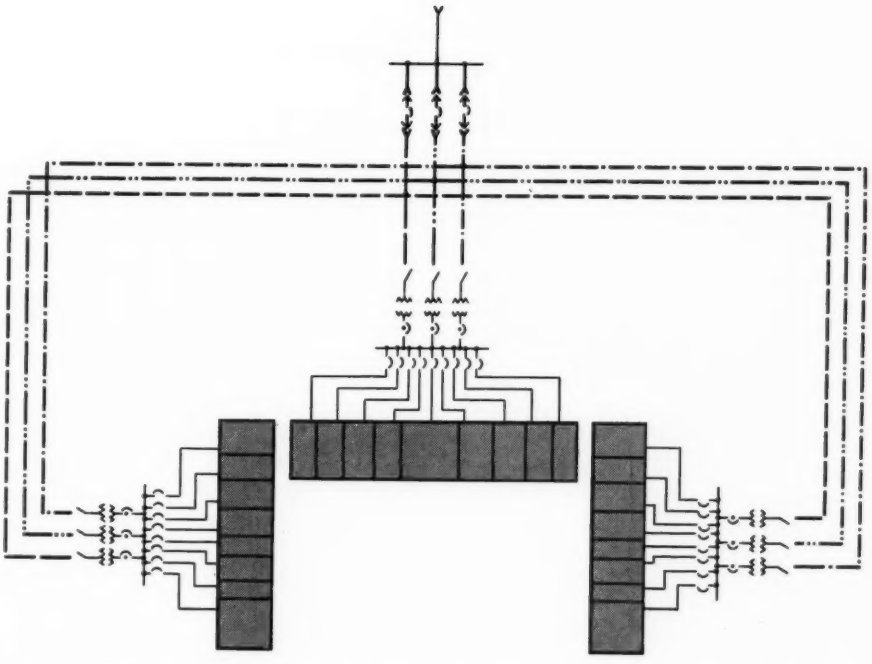


FIG. 10—SIMPLE SPOT-NETWORK SYSTEM FOR COURT-TYPE SHOPPING CENTER.

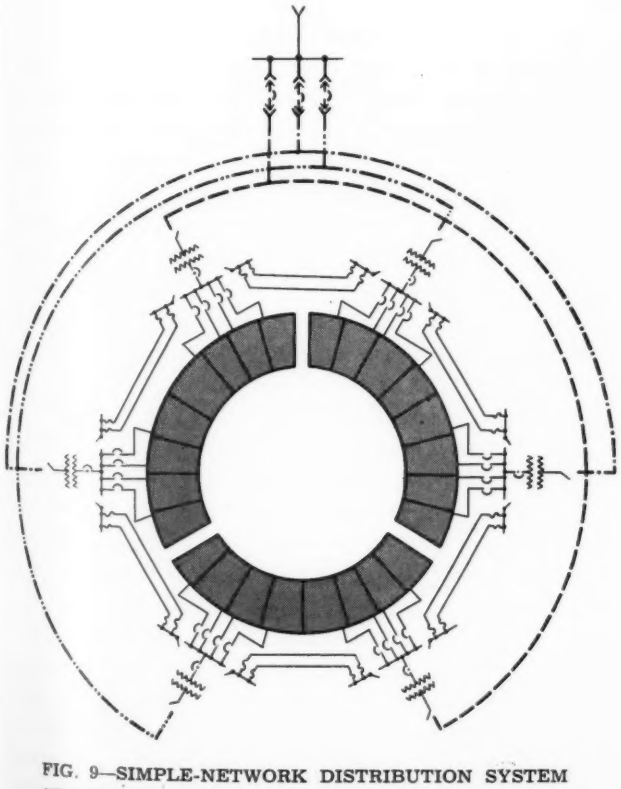


FIG. 9—SIMPLE-NETWORK DISTRIBUTION SYSTEM SERVING TYPICAL RING-TYPE SHOPPING CENTER.

Simple-Network System

In the simple-network system, shown in Fig. 9, power is fed to the transformers over two or more primary feeders. Each primary feeder (and its associated transformers) functions as a unit, and the system must be designed so that the entire load in the shopping center can be carried when one primary feeder and its transformers are out of service. Therefore, if only two or three primary feeders are used to supply the shopping center, an appreciable amount of spare feeder and transformer capacity must be installed in the system. This results in considerable expense. If four or more feeders are used, less spare capacity in primary cable and transformers is needed.

Power is fed from each network transformer through a network protector to a load bus. The stores are served from this bus over the usual radial circuits. Each load bus is tied to the adjacent load busses by a secondary loop, much the same as used in the banked-secondary system. The secondary loop provides an emergency supply to load busses whose transformers are disconnected from the system when a primary feeder or transformer fault occurs.

This simple-network system provides the maximum flexibility for meeting load growth or changes.

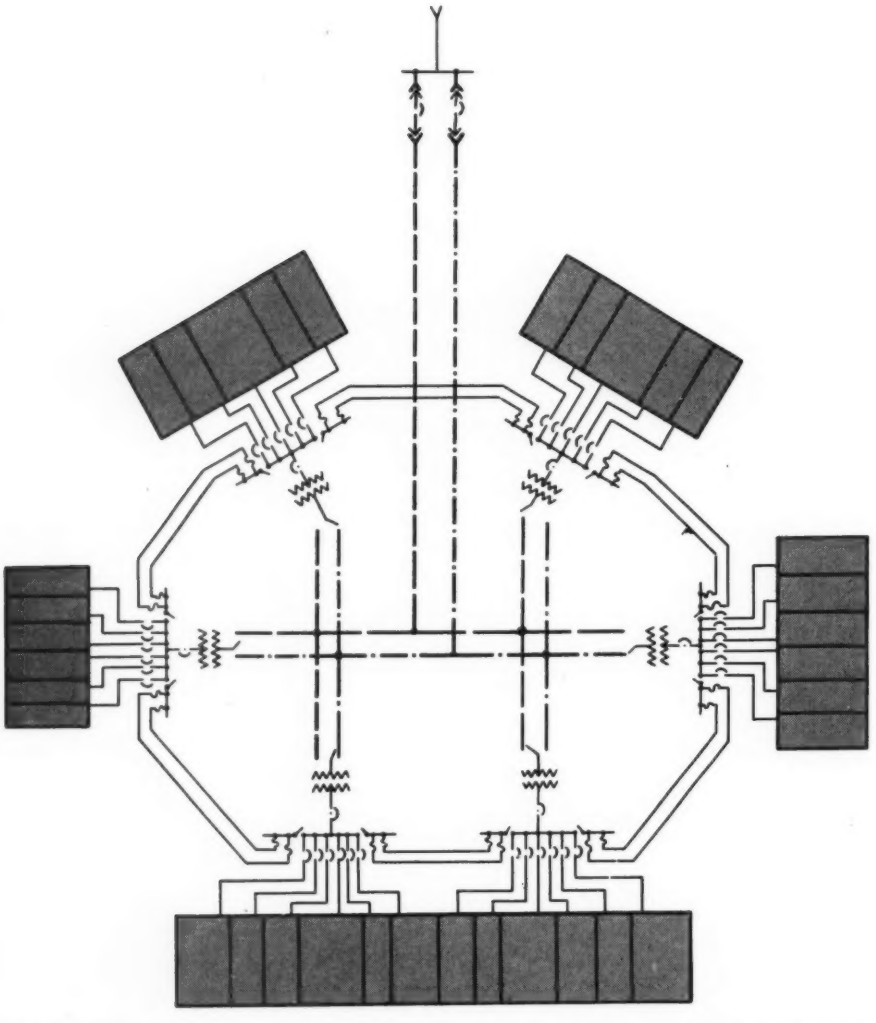


FIG. 11—PRIMARY-SELECTIVE NETWORK SYSTEM FOR "GROUP" SHOPPING CENTER.

Modifications and extensions to the system can be made without interrupting service to any of the loads; thus system changes can be made without interfering with the operation of the shopping center.

Simple Spot-Network System

The simple spot-network system, as shown in Fig. 10, is widely used in commercial buildings. In the simple spot-network system, to prevent a service interruption when a primary feeder or transformer fails, emergency capacity is provided by a multiplicity of primary feeder circuits and transformers at each load center instead of tying the load centers together with a secondary loop.

The simplest spot-network system resembles the secondary-selective system in that each load center is supplied over two or more primary feeders through two or more transformers. In this system, however, the two or more transformers feed through network protectors to a single load bus. Since the transformers at each load center operate in parallel, a transformer or feeder fault that removes one transformer from service does not cause any service interruption.

Spot-network systems are more economical than the other forms of network systems for shopping centers where there are heavy concentrations of load covering small areas, with considerable distances between these concentrations, and with very little load in the areas between them. The chief disadvantage of the spot-network systems is that these systems are not nearly as flexible in event of load growth and shifting loads as are the other network systems. Spot-network systems are used where a high degree of service continuity is desired, and flexibility is of minor importance. Their cost is less than the network systems using a secondary loop. The simple spot-network system is most economical where three or more primary feeders are used. This greatly reduces the amount of spare cable and transformer capacity required.

Primary-Selective Network System

The primary-selective network system is the most generally applicable and widely used form of secondary-network system in industrial plants and would appear to offer good possibilities for shopping centers. It is similar in principle to the simple-network system and offers almost all of its advantages. The primary-selective network system is the lowest cost network system for loads requiring only two or three primary feeders. Savings in initial cost, over the simple network system, are accomplished by using duplicate feeders to each transformer, as in the primary-selective radial system. This practically eliminates the necessity for spare transformer capacity and reduces the short-circuit duty on the load circuit breakers, but it does not reduce the amount of spare primary feeder capacity required.

Each transformer in the primary-selective network system is equipped with a primary selector switch. Two primary feeders are run to each transformer as shown in Fig. 11. In a shopping center requiring two primary feeders, each feeder must be capable of supplying the entire shopping center, since both feeders are taken to all network transformers. Each transformer is connected to a load bus through a network protector. The radial load circuits to the stores are connected to the bus through circuit breakers. A secondary loop, such as is used in the banked-secondary radial and simple-network

systems, connects each load bus to the two adjacent load busses. Half of the network transformers normally are connected to each primary feeder.

When primary feeder faults occur, the faulted feeder and its associated transformers are disconnected automatically from the system by the opening of its primary-feeder breaker and the associated network protectors. The entire shopping center then is carried over the remaining feeder and its associated transformers. The transformers associated with the faulted feeder can be connected quickly to the good feeder by manually operating their selector switches. This relieves the overloads on the transformer normally associated with the good feeder.

A transformer fault is isolated from the system in the same manner as a primary feeder fault. The defective transformer can be disconnected from the primary-feeder circuit by manually opening its selector switch. The feeder and its other transformers can be returned to service immediately by reclosing the primary-feeder breaker. This will cause the network protectors on all transformers but the defective one to close. Neither a primary feeder nor transformer fault will cause any interruption of service to the shopping center.

The cost of the primary-selective network system compares very favorably with that of the secondary-selective radial system. In shopping centers where the load is quite uniform, and there is little diversity between load centers, the secondary-selective radial system usually will be lower in initial investment than the primary-selective network system. In shopping centers where the load is not uniform, and where there is appreciable diversity between load centers, the primary-selective network system often will cost less than the secondary-selective radial system.

Stores usually will be supplied directly from the load busses to which the network transformers are connected. At times, a reduction in system cost can be made by serving the stores from the loop at points other than those at which power is fed into it. When this is done, the loop cables preferably should be paralleled and the loads taken off through load bus units. Taking loads from the secondary loop in this way reduces the average length of secondary load circuits and the amount of secondary copper.

By tapping all services to the stores from the secondary loop at the nearest point, the amount of secondary load copper can be reduced to a minimum. Practically, this cannot be done when using a cable secondary loop because of the necessity of paralleling the loop conductors and installing limiters at each take-off point. However, such a form of network system is practical if two or more parallel runs of plug-in bus-duct are used for the secondary loop. In this system, the transformers connect to bus units at each load center through network protectors, as shown in Fig. 11, except that there usually will not be load circuit breakers in the bus units. All stores generally are fed through the load-break switches, the limiter busses, and then through the limiters to the bus ducts, which tie the adjacent bus units together.

This form of network system requires more copper in the secondary loop than those using the cable loop previously described. It sacrifices something in

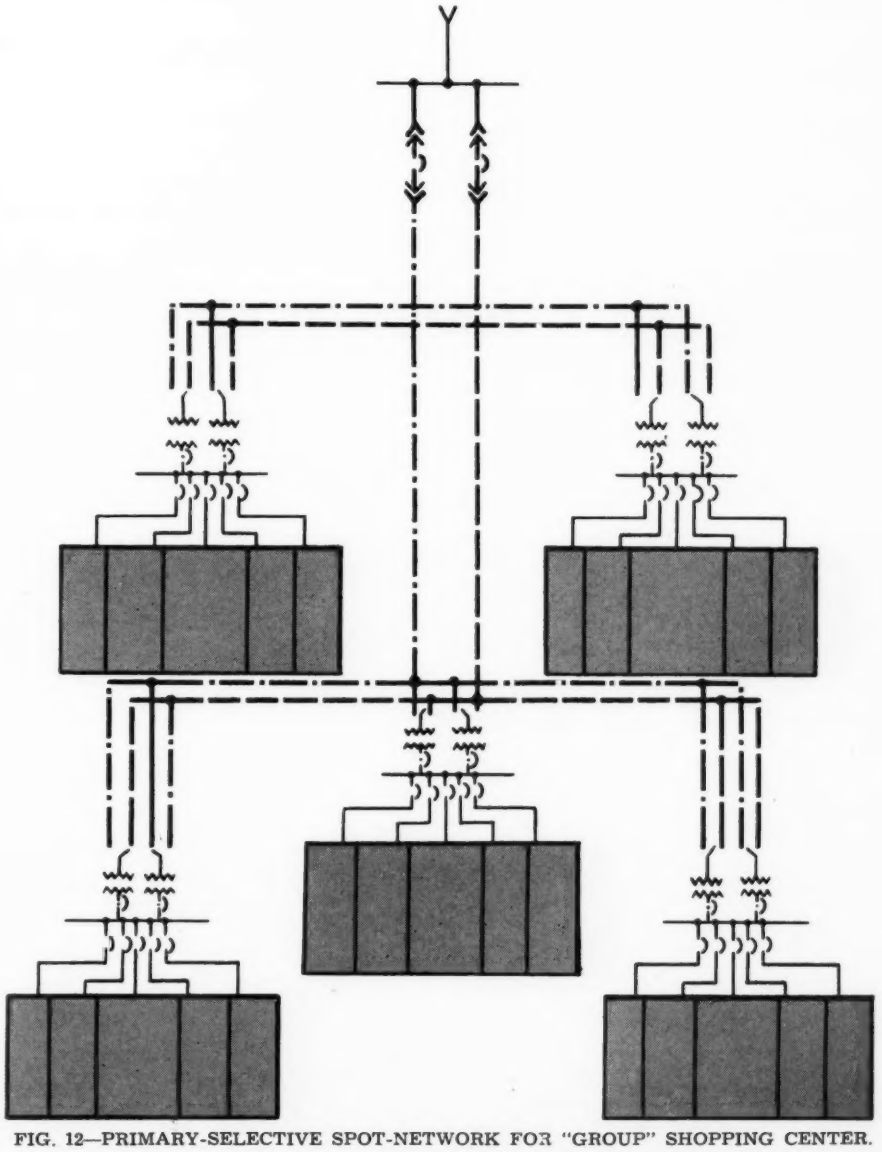


FIG. 12—PRIMARY-SELECTIVE SPOT-NETWORK FOR "GROUP" SHOPPING CENTER.

service continuity when compared with network systems where the stores are fed from bus units connected in a cable loop, for when a fault occurs in a section of the bus duct loop, the stores served from that section will be dropped when the limiters open.

Primary-Selective Spot-Network System

Just as with the simple-network system, the primary-selective network system may also take the form of a spot-network system. Each transformer in the primary-selective spot-network system is equipped with a primary selector switch that provides for a connection to either of two primary feeders, as shown in Fig. 12. This largely eliminates the necessity for spare transformer capacity, and the system ordinarily is designed without such capacity. Primary feeder and transformer faults are cleared without any interruption to service, just as they are in the simple spot-network system. When a primary feeder is de-energized because of a feeder fault, the transformers associated with the good feeder will carry 160 to 200 percent of rated load until the transformers normally associated with the defective feeder are switched to the good feeder by means of primary-selector switches. After this manual switching operation is completed, all overloads on the system are relieved.

If a transformer fails when using a spot-network system of this design, the load fed from its load bus must be reduced to prevent serious overloading of the other transformer connected to that bus. A transformer fault will occur so infrequently, however, that the cost of providing spare transformer capacity throughout the system cannot be justified. If this possibility of having to reduce load is objectionable, it will be cheaper to use the simple spot-network system than to provide the necessary spare capacity in the primary-selective spot-network system. The primary-selective spot-network system, when designed without spare transformer capacity and assuming two primary feeders and two transformers per load bus are used, will be cheaper than the simple spot-network system. When three or more primary feeders are required, the simple spot-network system will have a lower cost than the primary-selective spot-network system.

System Comparison

The table compares the twelve systems described for several magnitudes of load in each of the basic types of shopping centers. The comparisons are made on a column basis, and it is not intended that the ratings in different columns should be compared.

The ratings take into account initial investment, service continuity, flexibility in handling new or changing loads, operation and maintenance costs, voltage regulation, and efficiency. Each of these factors has been weighted in proportion to its relative importance for each load magnitude and type of shopping center. The "A" ratings indicate that analysis of the system has shown it to rate as the top of the twelve systems compared in each column. The other quality ratings are given in terms of percent of value of the "A" system.

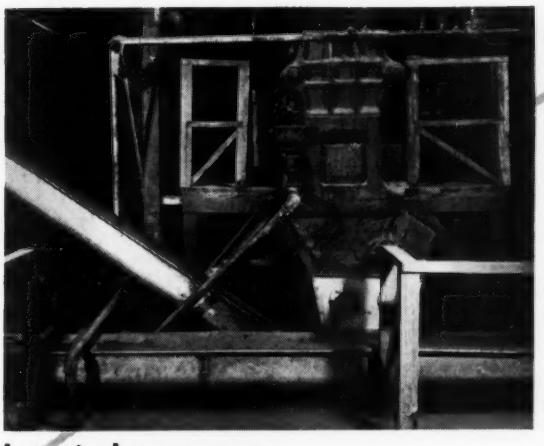
B—81 to 90% C—71 to 80%
D—61 to 70% E—51 to 60%
F—41 to 50%

It is hoped that this table will be valuable in the determination of what distribution system is best for a particular shopping center. ▲▲

COMPARISON OF DISTRIBUTION SYSTEMS

Type of Shopping Center	Strip or "L" and Court			Mall and Ring			Group or Cluster		
Load in kva	100-1000	1000-2500	2500-	100-1000	1000-2500	2500-	1000-2500	2500-5000	5000-
Type of Distribution System									
Conventional Simple-Radial	D	D	E	E	E	F+	E	F+	F
Modern Simple-Radial (a)	A	A	B	A—	B—	C	B—	C	D
Modern Simple-Radial (b)	C	C	C	C	D	D—	D	D—	E
Loop-Primary Radial	A	A	B+	B+	B	C	B	C	D
Banked-Secondary Radial	C	C	B	B	B—	C	B—	C	C
Primary-Selective Radial	B	B	B	B	C	D+	C	D+	D
Secondary-Selective Radial (a)	C—	C	C	D	D	D—	D	D—	E
Secondary-Selective Radial (b)	C—	C	C	D	D	D—	D	D—	E
Simple Network	D	D	A	B+	A—	A	A—	A	A
Simple Spot-Network	C	B	A—	B	B	B	B	B	B
Primary-Selective Network	D	C—	A	A	A	A	A	A	A
Primary-Selective Spot-Network	C	B	B	B	B	B	B	B	B

by conveyor belts



by spiral conveyors

If you move materials

by bucket elevators

by scraper conveyors

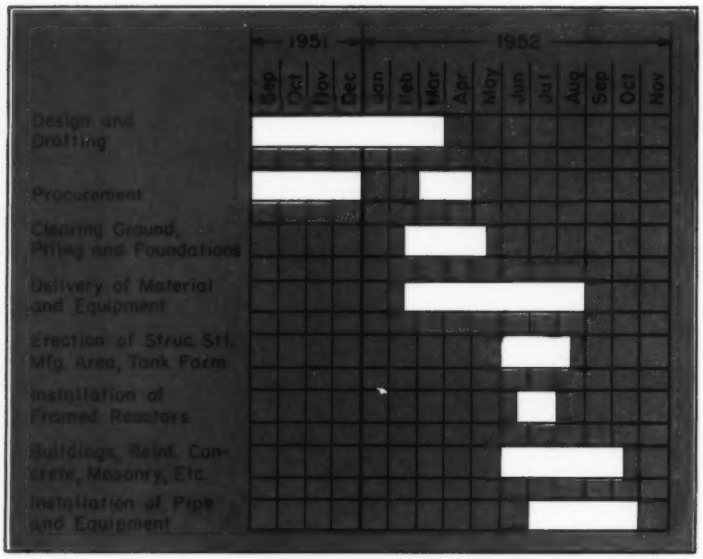
JEFFREY offers you

equipment incorporating the know-how gained in three-quarters of a century of studying and solving material-handling problems. Today, in thousands of plants throughout the world, Jeffrey conveying equipment is depended upon to maintain high production schedules, lighten the burden of labor and reduce operating costs.

Write for Catalog 860 describing Jeffrey material-handling and processing equipment. For high quality parts matching those originally installed on your equipment, get in touch with a nearby Jeffrey distributor or The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING



ACCURATELY RECORDED JOB SCHEDULES OF SIMILAR PROJECTS, EVEN OF A SIMPLE BAR TYPE AS SHOWN, OFTEN ARE EXCELLENT REFERENCES.

JOHN J. MAHONEY
Consulting Engineer

Try Yardsticks For Cost Control

AS CONSTRUCTION COSTS rise, consultants are being asked more frequently to explain their cost figures. Indirect services, such as engineering design, drafting, and construction supervision, in particular are being scrutinized by clients. Material and labor costs are accepted as a necessary evil but not so with engineering and drafting.

To satisfy management that these charges are in line with other costs, they must be recorded properly, analyzed, and kept under strict control by a project supervisor. Yardsticks are needed, and cost terms must be defined.

Yardsticks are set up by making comparisons. For example, when a consulting engineer reports that 8 percent of the money spent on a new fatty acid distillation unit was for drafting and 12 percent for engineering, this may be an excellent showing. But how can the consulting engineer prove it? Obviously, information from actual practice is needed. Some steps already have been taken by O'Donnell,[6] Lang,[7] and Reece.[9]

Yardsticks can be obtained by analyzing costs of jobs of a similar character where the engineering and drafting costs have been faithfully and accurately recorded. This is somewhat easier for a consulting engineer than a manufacturing firm, and it should be part of a conscious effort and not left to happenstance.

Terminology

First of all there must be a common understanding about the terms used by the consulting engineer and his client. For example, "engineering costs" in some companies include drafting salaries and overhead. In another, drafting is a separate item. Sometimes a draftsman will charge his time to engineering when he is in a supervisory position on the grounds that "supervisory time should be charged to engineering." This is wrong.

It is not difficult to distinguish between engineering, drafting, and clerical work. The engineer handles design calculations, estimates, equipment layout, and purchasing. Generally he is college trained and professionally licensed by one or more states. Drafting is clearly a service function. It consists of the translation of engineering thinking to a more tangible form of communication for the use of the client, field worker, and equipment manufacturer. The fact that a drawing is done by a licensed professional engineer does not alter the fact that it is drafting. Frequently, design calculations and drafting are done by the same man—one job is part of the other. Then it is necessary to

estimate the time involved on each aspect of the job. Obviously, we cannot have yardsticks or cost control if the recording of these various expenses is lost in a confusion of terms.

Some rather common expressions used in engineering are as follows:

Cost	Construction cost
Plant cost	Capital outlay
Building cost	Erection cost
Total cost	Total erected cost

Any one, or all eight, may be used in conversation and yet the following component parts may, or may not, be included.

Land	Engineering
Legal fees	Fees and profit
Drafting	Construction supervision
	Research and development

Under these conditions, it is understandable that confusion will result and make cost compilation difficult. A glossary of terms, approved by a national standards group, would be a welcome addition to our technical literature. Other fields, such as chemical development,[1] already have simplified some of their terms. Textbooks by Vilbrandt[5] and Tyler;[2] articles by Lang,[7] O'Donnell,[6] and Beattie and Vivian;[14] and government publications by such agencies as the Bureau of Mines[13] offer many elaborate definitions for the terms used in cost analysis, and also provide excellent check lists for consultants engaged in preparing industrial plant construction estimates and production forecasts.

Compilation of Cost Data

The consulting engineer generally will handle the accounting on a job as a component of the over-all project management. A manufacturing firm often does not. For them, engineering and accounting are two segregated staff functions. The consultant, therefore, must sell this idea to the client. Proper cost analysis and the use of yardsticks depend on cost comparisons. Similarity in recording the data is a necessity. The following listing is suggested as a guide.

¶ Equipment
¶ Installation
¶ Engineering
¶ Drafting
¶ Clerical
¶ Outside contracts and miscellaneous

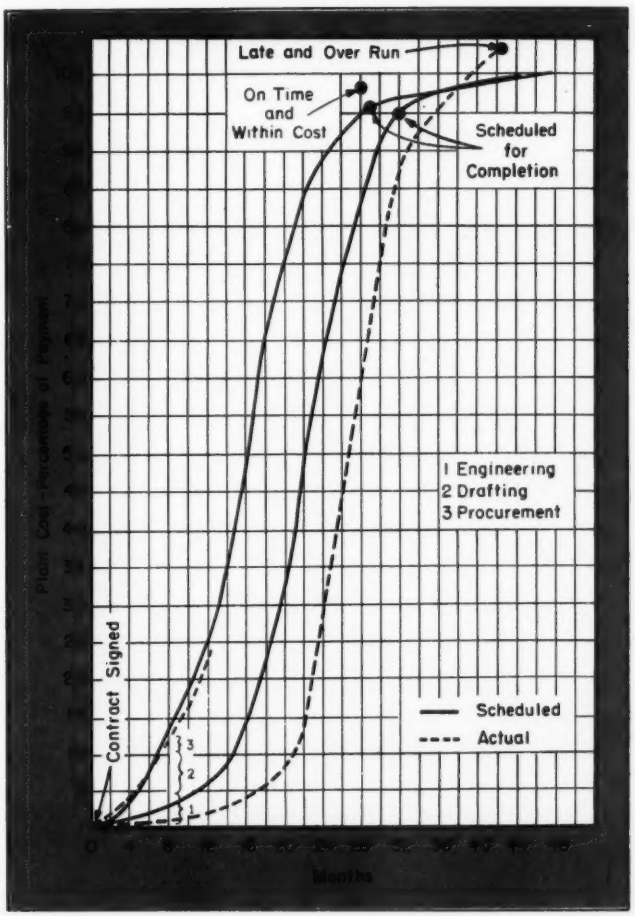
Obvious discrepancies should be explained. For example, these items may not add up to the total cost shown. Perhaps land or legal fees have been omitted; this would require an explanation. On a large project, subdivisions are needed, but generally speaking, any system is a good system if it can be compared with other cost estimates on other installations. Dissimilar systems often prevent proper comparisons. Sometimes obvious entries are poorly presented; for example, the "installed cost" of a comfort air conditioning system in a large plant may or may not include drafting and engineering. Tracking this item down can be time consuming and annoying. Examples of good systems have been presented by Lang,[7] Vilbrandt,[5] and others.

A banker who is asked for a loan has certain yardsticks to follow.[12] He is interested in the borrower's ratio of assets to debt and debt to capital. The business man has operating ratios that he uses in managing his business and in keeping track of the competition.[4] Consulting engineers usually have good cost systems, but their clients often neglect engineering cost analysis and yardsticks in their own engineering departments because, relatively speaking, manufacturing costs are more important. The consultant's job is that much more difficult because engineer and client do not have similar cost outlooks.

Setting Up Yardsticks

Since the dollar varies in value from year to year, yardsticks must be expressed in comparative rather than absolute terms, such as:

¶ Percentage of a specific cost, or of a total cost.
¶ Ratio of two costs, which make up a specific cost. For example, on the average it may cost one



"S" CURVES, USED IN CONJUNCTION WITH JOB SCHEDULES, ARE VALUABLE FOR CHECKING THE COURSE OF A PROJECT.

TYPICAL COST ESTIMATE

Item	*Cost*	
Equipment		
Hydrogenator	$14,000	(9.0%)
Adsorber	1,000	(0.6%)
H_2 generators (2) @ $7,000 each	14,000	(9.0%)
Motor-generator set	11,500	(7.4%)
H_2 compressor	4,400	(2.9%)
Steam jet vacuum unit	1,500	(1.0%)
Filter press pump and motor	800	(0.5%)
Fats meter	500	(0.3%)
Hydrogen cylinders	2,000	(1.3%)
Piping and insulation	6,000	(3.9%)
Instruments and control valves	2,500	(1.6%)
Starters, pushbuttons	1,000	(0.6%)
Equipment and piping total	$59,200	(38.1%)
Installation		
Equipment (including $2,000 for structural steel)	$14,000	(9.0%)
Piping	6,000	(3.9%)
Electrical	2,000	(1.3%)
Instrumentation	1,000	(0.6%)
Installation total	$23,000	(14.8%)
Other costs		
Tariff, sales tax	$10,800	(7.0%)
Freight, insurance	2,500	(1.6%)
Office engineering	11,000	(7.1%)
Field engineering	7,000	(4.5%)
Procurement	3,000	(2.0%)
Drafting	7,500	(4.9%)
Clerical	1,000	(0.6%)
Contingency @ 10%	15,000	(9.7%)
Profit @ 10%	15,000	(9.7%)
Total other costs	$72,800	(47.1%)
Total plant cost	$155,000	(100.0%)

dollar to install one dollar's worth of stainless steel piping, valves, and fittings.[5]

¶ A time factor against a specific task; for example, the hours necessary to complete a drawing.

¶ Integral cost data available from previous jobs. Complete job costs broken down to show how each dollar was spent help in planning new ventures.[7]

¶ Differential cost data. A precise determination of one element of cost often will make it easier to establish other elements. Reece[9] has provided a relationship between engineering and drafting as an example.

In using these yardsticks, however, great care must be exercised in pointing out what is included in these costs and what is not.

Common Yardsticks

The following yardsticks and reading references are offered as guides:

¶ Engineering and drafting usually will cost from two to three times the hourly salary rate when the work is done on an hourly basis. Work on a retainer plan or on a contractural obligation will be less expensive, perhaps from 1.75 to 2.50 times the hourly rate.

¶ Drafting work of a somewhat routine nature like steel detailing may be done for as little as 1.50 times the hourly rate, although fringe benefits, such as sick leave, holidays, premium time, and insurance programs must be considered.

¶ Drafting costs are, of course, dependent on the volume and on the drawing size among other factors. As a rough guide, about 200 drawings are needed on a complete plant design that totals $2 million. Perry[11] in a recent article suggests a similar ratio and offers a breakdown among the various drafting subdivisions such as mechanical, structural, and electrical. Drafting will vary with the project size.

¶ Salaries for engineers, draftsmen, and clerks will vary with age, experience, and locality. Many publications have offered salary charts for engineers in recent years.

¶ Procurement, the preparation and handling of purchase orders, can be a big part of the indirect costs on a construction project. As a rough yardstick, 25 to 40 hours per purchase order is a guide that is helpful when setting up the budget. On one $2 million chemical plant installation, about 110 purchase orders were written and 3500 hours were allocated. Obviously, it makes a difference how the word "procurement" is defined. Differences of opinion are frequent.

¶ Interest charges during construction can be sizable and deserve careful consideration. Three items are important: the estimated length of the project; the schedule of payments as to the amount and time; and the rate of interest on the borrowed capital.

¶ Yield on investment is an important consideration in any construction project, and the consulting engineer often is brought in on discussions of plant life, payout time, and plant production capacity. A schedule of investment yields has been prepared by Happel and Aries in *Chemical Engineering Progress*,[8] March 1950. The acceptable net profit for industrial chemical ventures will range from "low risk," 7 percent to a "high risk," 27 percent. Drugs and pharmaceuticals will be between 15 and 35 percent. Petroleum, paints, varnishes, and lacquers will vary from 10 to 27 percent.

¶ James Weaver's article "Need Help in Finding Cost Data?," *Chemical Engineering*,[3] October 1954. This compilation of source data with 402 items is an excellent fund of information. In June 1955, Weaver provided additional data.

¶ Indirect costs such as engineering, drafting, and construction supervision are covered by O'Donnell in *Chemical Engineering*,[6] January 1953, by Reece in *Mechanical Engineering*,[9] May 1955, and Bean in *Industrial and Engineering Chemistry*,[10] Oct. 1951.

Profit

The determination of the term profit, or fee as it sometimes is called, is not an easy task. The consulting firm, if it is to survive, must have a capable management that can set its rates at a level that will insure a profitable operation. A manufacturing firm

that retains the consulting engineer often has only a hazy idea of this item and will fail to consider it or — worse still — will just consider it as excessive. The client also may fail to consider that the timing of the payments is important.

If the consultant is paid periodically as the job progresses, then his financing is somewhat simpler, and the profit can be set lower. If he is kept waiting for his funds, his financial position deteriorates, and a higher profit is the tendency. The consulting engineer must explain to the client that capital tied up in men and materials involves interest as an item of expense, and the profit term will be influenced accordingly.

Current tax laws and state regulations regarding consulting engineers make it difficult for the consultant to set aside a cash reserve. Financing a project is that much more difficult as a result. Unincorporated practice by consulting engineers at a time when construction projects are becoming larger and larger poses some rather difficult problems from a financial point of view. A frank discussion of profit and fee with the client is one course of action for the consultant. Secrecy is an alternative.

When Yardsticks Would Be Used

A small complete project costing, say, $10,000 does not call for elaborate yardsticks. However, it is a good policy for the consultant to set up a minimum project cost of about $100,000 when cost yardsticks should be used. A cost sheet then would be set up showing equipment, installation, engineering, and drafting. As a matter of convenience, it should fit on a single sheet of paper and should be filed with the cost estimates, budget, and schedule on the job. Management then can check performance against prediction. The file will serve as a guide for future jobs, since percentages for engineering, drafting, and all other items will be recorded.

Cost Supervision

The project supervisor operating under a good system of cost control will have various titles depending on the size and character of the consulting firm. Some use the term "account executive," others use "project engineer" or "job engineer." Regardless of title used, true control is possible only when the supervisor has complete financial control of the project. In simpler terms, a man is truly a supervisor when he can halt or initiate work — auditing is not enough.

Small companies sometimes do an excellent job of plant construction because they have fewer specialists and cannot shift the burden so readily. An engineer is given complete responsibility for a job, and asked for final results.

A vertical arrangement (project type) is preferable to a horizontal type (departmental) if the objective is to get a project completed with speed and economy. On the other hand, a horizontal system is best for training and personnel administration.

Organizational Problems

There is another system in which "coordinators," "collators," "expeditors," or "liaison men" are used. With a strong departmental system, this coordinator frequently does not have enough authority to overrule department heads in a controversy and must take what he can get. That the department head is an older man usually complicates the problem.

Unified job control (including financial management) breaks down when department heads actually run the show, unless the firm has highly trained department heads, a good standards system, and frequent conferences to iron out difficulties. It is not wise to select a man with a staff position to audit the costs on a project. The cost supervisor ought to be in a line set up so he can adjust the costs as he audits them.

The project system is a good method of keeping a job rolling and fixing responsibility for performance. The project supervisor should be made responsible for the successful completion of the job and be expected to treat it as an investment in time and money. It is up to him to see that the investments are wisely placed. ▲▲

BIBLIOGRAPHY

1. *Successful Commercial Chemical Development,* Corley, H. M., Editor-in-chief, John Wiley and Sons.

2. *Chemical Engineering Economics,* 3rd Edition, Tyler, Chaplin, McGraw-Hill Book Co.

3. "Need Help in Finding Cost Data?," Weaver, James B., *Chemical Engineering,* October 1954.

4. "Fourteen Important Ratios," *Dun's Review and Modern Industry,* December 1954.

5. *Chemical Engineering Plant Design,* 3rd Edition, Vilbrandt, F. C., McGraw-Hill Book Co.

6. "New Correlation of Engineering and Other Indirect Project Costs," O'Donnell, James P., *Chemical Engineering,* January 1953.

7. "Cost Relationships in Preliminary Cost Estimation," Lang, Hans J., *Chemical Engineering,* October 1947.

8. "Venture Profitability in Economic Balances," Happel, John and Aries, R. S., *Chemical Engineering Progress,* March 1950.

9. "Controlling Engineering Costs," Reece, K. W., *Mechanical Engineering,* May 1955.

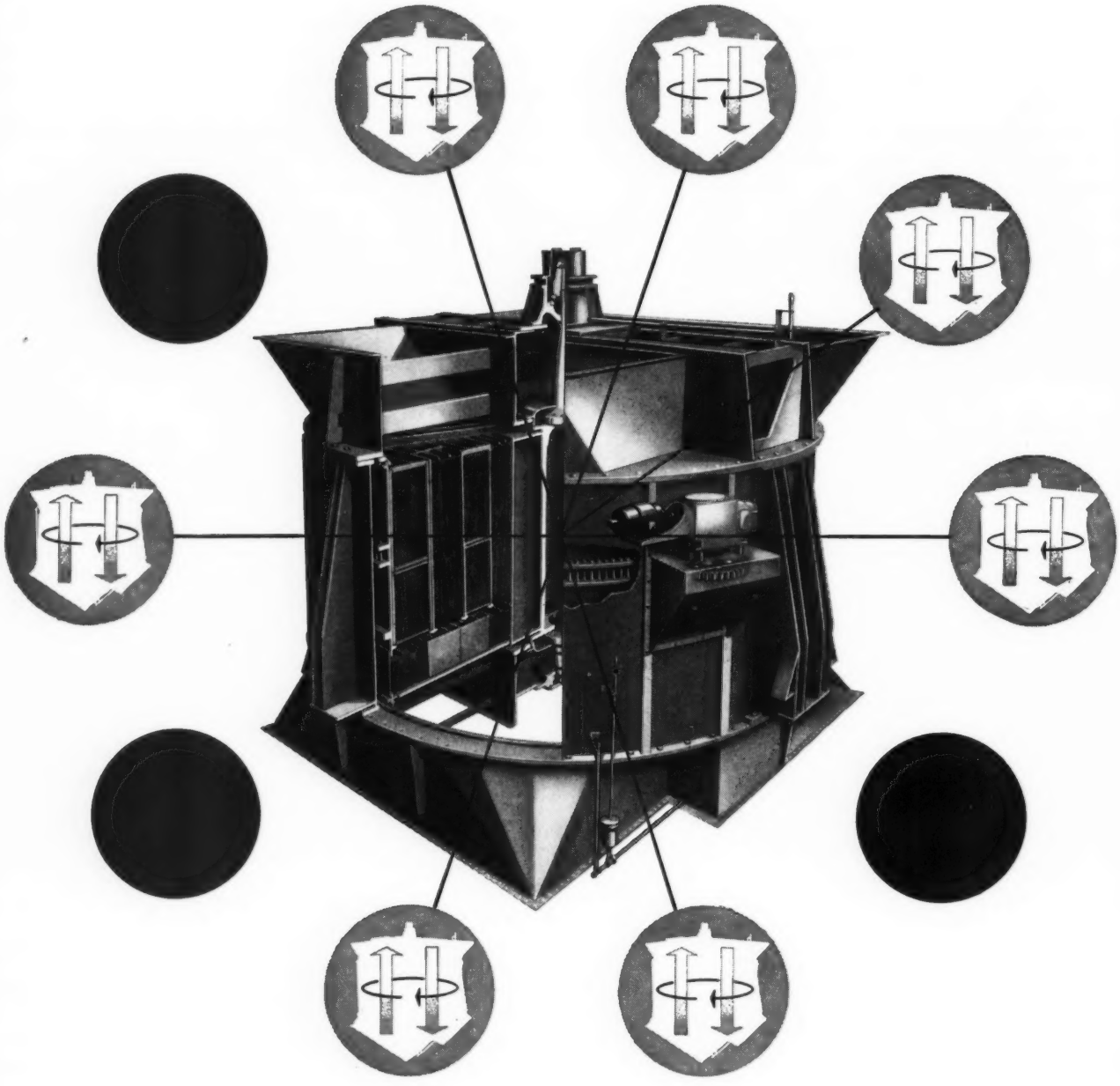
10. "Estimating Construction Costs in Chemical Process Industries," Bean, Theron W., *Industrial and Engineering Chemistry,* October 1951.

11. "The Integration of Engineering Skills in Chemical Plant Construction," Perry, Charles, *Chemical Engineering Progress,* August 1954.

12. "How to Make Bankers Say Yes," *Food Engineering,* October 1954.

13. *Guide for Making Estimates for Chemical Type Operations,* Bureau of Mines Report of Investigations 4534, November 1949.

14. "When Making Cost Estimates, Watch Your Language," Beattie, R. D. and Vivian, J. E., *Chemical Engineering,* January 1953.



7 out of 10 air preheater installations are Ljungstrom®

Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

FUEL ECONOMY is the big reason. Size for size, the Ljungstrom recovers more heat than any other type of air preheater. And with every 45-50 F of air preheat you cut your fuel bill 1%.

Write now for your copy of our 38-page manual, for handy reference.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

JOHN R. MAYER
Reports Editor
Ebasco Services Inc.

How Ebasco Prepares Technical Reports

ALTHOUGH A CONSULTING business offers its clients many valuable services in the conduct of its affairs, the one end product of consulting work that is clearly tangible and permanently identified with the consulting firm is the final report setting forth the results of the work performed. It is, therefore, only common sense to make that end product as good as it can possibly be, both in content and appearance.

With this in mind Ebasco Services Incorporated began a long-range, report-improvement program a few years ago, designed to standardize its report work at the highest level of quality practicable. This program contemplated improvement in report writing as a functional art as well as improvement in physical appearance. Another objective was to relieve consultants of as much report preparation work as possible and give them more time to devote to their primary productive work — consulting.

Report Volume High

For Ebasco, the question of how well the firm's reports are received by clients is of considerable importance, for although a large portion of the firm's work is in design and construction activities, the volume of its consulting work has climbed to a current level of some 375 completed reports per year. This means that on each working day, on the average, 1½ client jobs are completed, including issuance of the report. Some of these reports may be only 30 or 40 pages in length, while others may go as high as 200 pages, including exhibits, schedules, and various other types of descriptive material.

Before the report-improvement program began, the procedures involved in issuing a report to a client and the quality of both content and appearance were as varied as the consulting services offered by the firm. Each department had its own standards of format, style, method of reproduction, and type of cover; and to a large extent each consultant was on his own when it came to organizing and writing his report. This meant the quality of writing in each report was related directly to the individual consultant's talent for report writing. Hence the words "An Ebasco Report" could have an entirely different meaning for different clients.

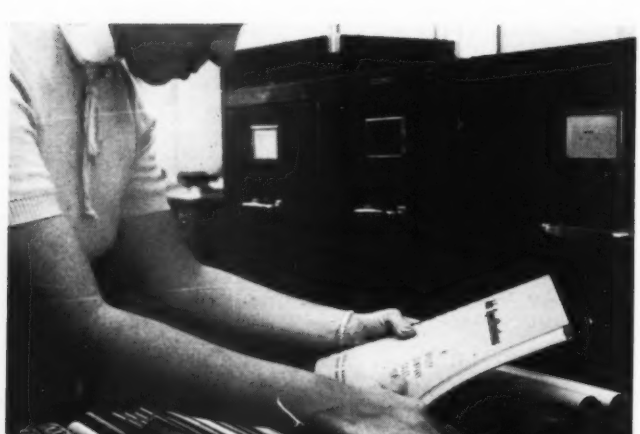
At that same time Ebasco's Reproduction Division, where most reports were mimeographed or hectographed, was faced with the permanent dilemma of whose job was to come first whenever there was a conflict in deadline demands. With 20 or more departments and divisions making promises to clients, such conflicts were a part of the daily routine.

Changes in Routine

Although the measures taken by Ebasco to improve this over-all situation were effected step-by-step, over a considerable period of time, and still are continuing, they consisted of three major changes:

¶ The Reproduction Division was equipped with new multilith machines for report reproduction work and with special binding and auxiliary equipment to permit rapid and high quality production of printed, plastic-bound books.

¶ The Stenographic Division of Office Service Department previously had been used only occasionally for typing when the department preparing the report was temporarily unable to handle all its own work. This Division was enlarged substantially and equipped with the most modern typewriters and



ONE COPY OF EACH REPORT PRODUCED BY EBASCO IN ONE YEAR NEARLY FILLS THREE FOUR-DRAWER FILES.

Varityping machines available. The entire operation was geared to multilith reproduction typing, and job standards for personnel were set at the highest level for reproduction typists.

¶ A completely new division — the Reports Preparation Division — was set up to coordinate all Ebasco report-writing and report-producing operations through one central point. It was contemplated that this division, over a period of time, would make the change-over to centralized report operations, not by carrying out a management dictate to that effect, but by selling the idea gradually to all consulting departments and divisions by virtue of the services that now could be offered to them.

Standards Manual

In carrying out its assignment the Reports Preparation Division had to prepare a complete set of standards for both the writing and the physical characteristics of an Ebasco report. These standards prescribed the proper methods of planning a report and organizing its contents into logical parts, the basic principles of a good report and good report-writing; typing, style, and format rules; and methods of reproduction, cover setups, and binds. The work of devising these standards required a great deal of research and discussion with department managers and others concerned, culminating eventually in the publishing of a 100-page permanent standards manual for company-wide use.

Procedures

The next step was to set up a procedural system for coordinating all production activities. Forms were designed and procedures developed for accurate scheduling of all report work, so that a commitment to one client could be met without disappointing another.

As the selling program got under way, the Reports Preparation Division offered several important services to all departments and consultants in connection with their report work:

¶ Assistance in planning the structure of a report, writing the original text, or revising and polishing the final draft.

¶ Consultation and experienced handling of any reproduction problem in exhibit work, special effects, and other matters related to reproduction.

¶ A complete production service through use of which the originating department could turn over the draft of a report to the Reports Preparation Division and receive back, at a time appropriate to their commitment to the client, the printed and bound copies of the report.

It was contemplated that the functions of the Reports Preparation Division not only would provide the departments and consultants with all those services but also would assure management that all Ebasco reports were being closely controlled both as to writing quality of content and adherence to the high standards of physical appearance as prescribed by the Reports Manual.

The Program in Action

The entire report-improvement program now has been in operation for a considerable period of time and is functioning successfully and proving its value to the company. The present functions of the Reports Preparation Division can be summarized briefly as the planning and coordinating of all those processes and activities involved in transforming a collection of loose, typewritten or handwritten sheets plus drawings or illustrations of some kind into a formal report printed and bound in a permanent cover.

These processes and activities begin when the Division is notified by the originating department or consultant that work has been started on a report. At that point the Production Controller makes tentative provisions for that report in the scheduling of work to be done in the future. Subsequently the scheduling is revised as the time draws nearer for the report to be processed and a more definite date is discernible.

Editorial Treatment

As portions of the draft are completed by the consultant, they are sent to the Reports Preparation Division for editorial treatment. The Reports Editor reviews the material for general structure and effect, language usage, style, grammar, format, clarification of obscure passages, and inconsistencies of fact. Where any considerable revision is thought desirable, the suggested changes are discussed with the consultant to assure that his meaning will be clear in the final form.

After this editorial treatment the completed draft is ready for processing by the Production Controller. His first step is to prepare for printing any exhibit material of such size or nature that it cannot be re-

produced by Ebasco's Reproduction Division but must be sent to an outside printer. The text, cover setup, and other material to be handled in the building then is numbered and prepared for typing. Simultaneously, orders are prepared for the Reproduction Division and the Reproduction Typing Pool detailing all specifications concerning deadline requirements, the method of composition, runoff, collation, binding, and disposition of finished copies. All material then is forwarded either to Typing or to Reproduction for processing.

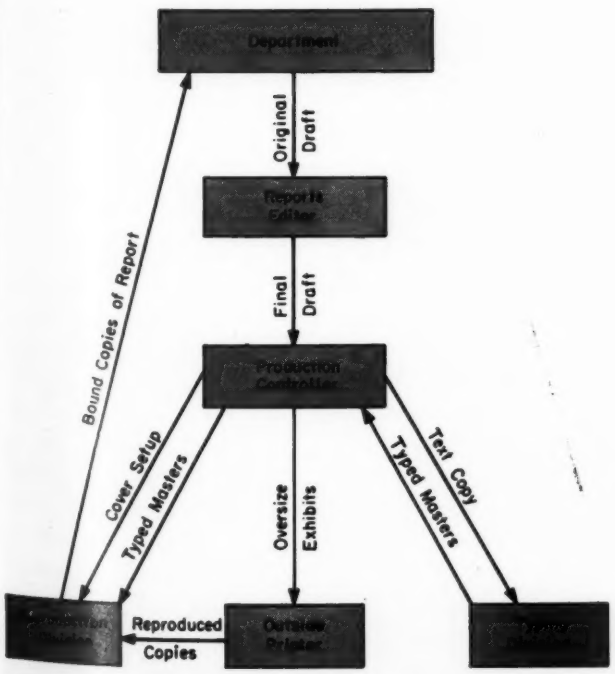
Copy Preparation

Most reports, incidentally, are prepared on the IBM executive model typewriter; a few are prepared by Varityper where special conditions exist. To handle the current volume of report work requires a staff of 27, including 15 typists, 6 Varitypists, 4 proofreaders, a supervisor, and an assistant.

As the typed or Varityped masters are finished and returned to the Reports Preparation Division, they are placed in their proper sequence, and the pages are numbered. The masters are returned briefly to the originating department for a final look and then forwarded to the Reproduction Division for runoff. As this process proceeds it is essential for records to be kept of the whereabouts and status of all the various elements of the report to make certain that all parts eventually are brought back together again and placed in their proper sequence.

Production of the report is handled by a staff of 13 in the Reproduction Division. Report covers are printed by letterpress; text and smaller size exhibit material by multilith. (If preliminary copies are prepared for client approval, these usually are hectographed.) The reproduced sheets are collated into books, punched, and then bound with a plastic element. Before being distributed, each copy is checked for accuracy of collation and quality of reproduction.

EBASCO FINDS MANUAL COLLATING EFFECTIVE. EXPERIENCED PERSONNEL COLLATE 3000 SHEETS AN HOUR.



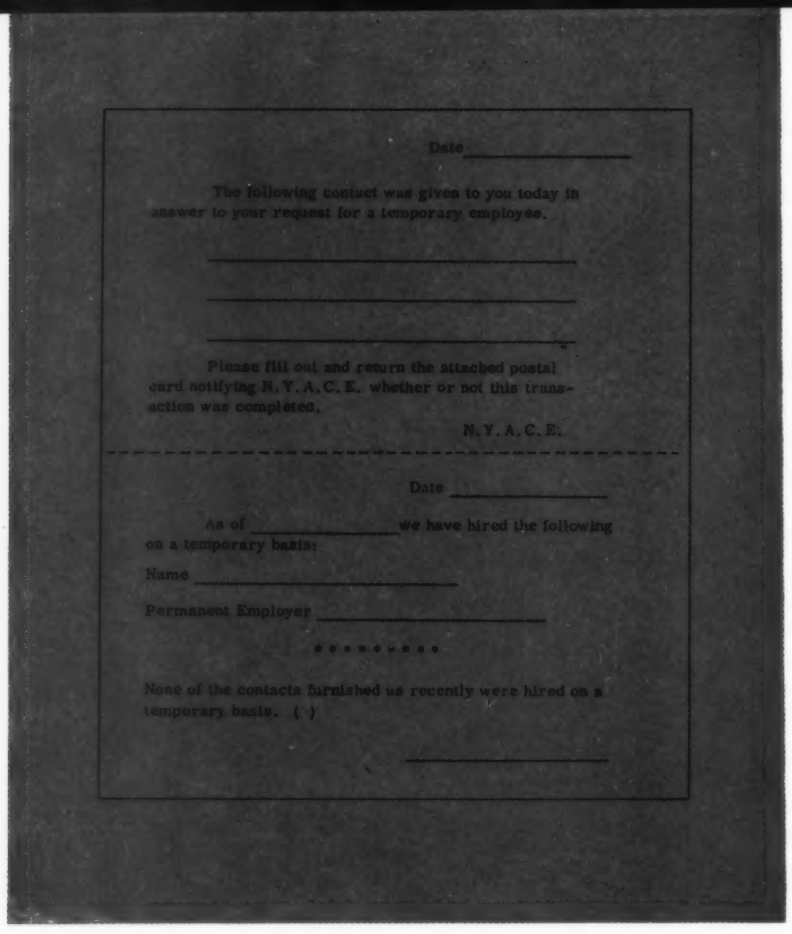
FLOW CHART OF THE REPORTS PREPARATION DIVISION.

Future Goals

It has taken a long time to achieve most of the aims of the report-improvement program, and new improvements always are being sought. One principal objective that has not yet been achieved completely is that of relieving the consultants of the unproductive work of report writing so as to give them increased time for the productive work of consulting. At present, they can be relieved of report writing chores to a limited extent once they have prepared the draft of their report. But the ultimate aim is to free them further from this work by expanding the Reports Preparation Division functions to include a Report-Writing Center.

To what extent such a goal can be achieved, however, remains to be seen, for there are limits to how far one person can go in writing a report containing the thoughts of someone else. Somehow those thoughts must first be expressed and in practice this may mean writing them down — preparing a draft.

In the meantime Ebasco's consultants are being offered every possible assistance in writing their reports; even short articles on practical problems of report writing are issued regularly and distributed to them. The problems involved in getting their reports reproduced, which were once the responsibility of the individual department or consultant, now are handled promptly and efficiently by a service specially designed for that purpose. ▲▲



Date _____

The following contact was given to you today in answer to your request for a temporary employee.

_____

_____

_____

Please fill out and return the attached postal card notifying N.Y.A.C.E. whether or not this transaction was completed.

N.Y.A.C.E.

Date _____

As of _____ we have hired the following on a temporary basis:

Name _____

Permanent Employer _____

* * * * * * * * * *

None of the contacts furnished us recently were hired on a temporary basis. ( )

_____

SAMUEL A. BOGEN
Bogen and Alston

N.Y.A.C.E. Sets Up an "Employees Pool"

CE exclusive

THE SECOND most difficult problem in running any consulting engineering practice is obtaining drafting room personnel of suitable caliber during periods of peak load. The first most difficult problem is figuring out what to do with these men after the peak period has passed.

The New York Association of Consulting Engineers has embarked upon a plan, which it is hoped, will solve both of these problems. The plan is called the "Employees Pool."

How the Employees Pool Works

Members of the Association advise the Executive Secretary of the Association when they are temporarily in any need of men, or when they have men to spare temporarily. They give the following data:

¶ The employee's specialty (such as structural, heating, electrical . . .).

¶ His salary (or the range they wish to pay).

¶ When available (or when required).

¶ Approximately how long available (or required).

N.Y.A.C.E.'s office acts as a clearing house for this information, and attempts to bring together those employers who need men with those employers who have men available at the time. To facilitate requests, a Recordex visible folder is set up to show "Required" and "Available" men in the various categories such as air conditioning, heating, plumbing. . . When a request for a temporary employee is received, contacts are supplied promptly, and then confirmed by sending out the double postcard illustrated. Members of the Association may, of course, accept or reject any of the men offered.

How Salaries Are Paid

When a temporary exchange is consummated, the temporary employer pays the permanent employer, weekly, an amount equal to the employee's pay rate plus 25 percent to cover all taxes and bookkeeping costs. This percentage applies to overtime bonus pay as well as straight time; the permanent employer's practices governing overtime rates are considered binding during the temporary employment. The employee receives his pay check from his permanent employer on his normal payday. The temporary employer is expected to reimburse the permanent employer not later than one week after each payday.

For each completed exchange, the Association receives a fee of $10. This is paid by the tempo-

rary employer who, presumably flushed with success, can afford it.

Unless some other agreement is reached between the firms involved, each man can be returned by his temporary employer to his permanent employer without notice. He can be recalled by his permanent employer on two weeks notice.

No Employee Contact

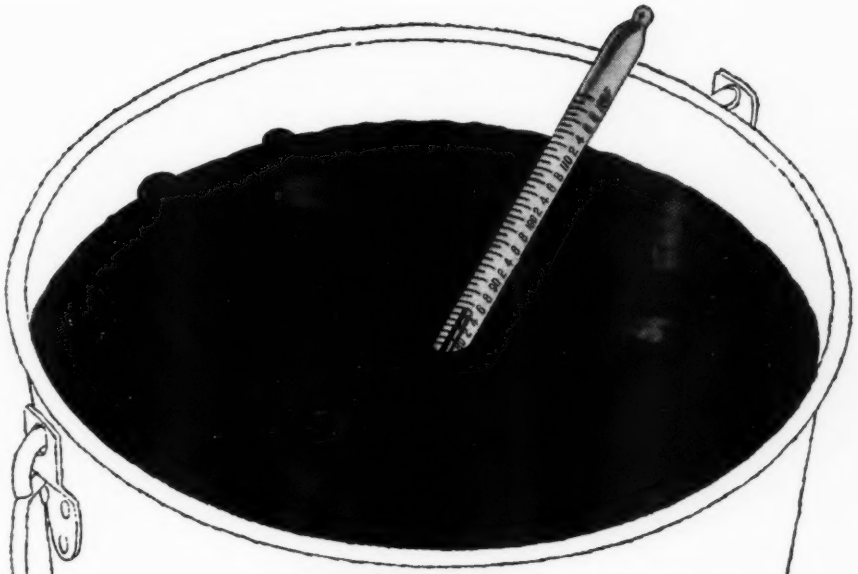
Since the N.Y.A.C.E. office has no contact with the employee, it is in no sense regarded as an employment agency. Employees are not referred to the New York Association of Consulting Engineers under any circumstance. Its function in this procedure is purely clerical, and it has no responsibility to any of the firms or individuals involved.

We expect that at times there will be a temptation to use the pool to unload unqualified or overpaid men. However, we feel that any member who does this persistently soon will find that his tender of available men finds no takers. By the same token, we believe that none of the Association's members will approach a temporary employee in regard to permanent employment, since this would violate the basic spirit of the arrangement.

Benefits

It is believed that this pooling arrangement will prove beneficial to all the employers involved and also will help the employee to maintain steadier employment than would otherwise be possible. The employee's record also will show a continuity of employment by a single employer, which looks a great deal better for him than a series of jumps from job to job.

There may, of course, be a certain amount of embarrassment involved for the consulting engineer who has to reveal that his office is not fully loaded at any time. Those whose sensibilities in this regard are strong will be prevented from taking advantage of the pool, and will lose the material benefits that are offered. Eventually the Association feels that most of its members will wish at some time to take part in the pool arrangement. ▲▲



This
is what you buy...

When you invest hundreds of thousands of dollars in a cooling tower, what you are actually buying is the tower's consistent ability to deliver *cold water* at specified temperature and volume . . . at an economical price per gpm.

And because actual performance is an "unknown" until the tower is in operation, you purchase cooling towers largely on faith in the manufacturer.

You can place your absolute confidence in The Marley Company's ability to deliver the cold water you specify. At Marley, water cooling has been an exclusive specialization—not a sideline—for 35 years. Every company facility—design, research, engineering, production—is devoted 100% to the science and techniques of water cooling. This single-minded approach to water cooling problems has resulted in Marley's undisputed leadership in the water cooling field by any standards you care to apply.

The Marley Company, however, does not ask you to buy its cooling towers on blind faith. Rather, Marley urges every industrial tower owner to test his tower and has paved the way by developing the simplest and most authoritative tower-testing procedure. And finally, every Marley cooling tower, from the moment it starts, receives the benefit of professional observation and inspection by Marley field engineers—specialists in maintaining both tower function and tower structure in excellent condition.

The Marley Company
Kansas City 14, Missouri

MARLEY

Batch or continuous

UNITIZED WEIGHING

easily installed...lower in cost

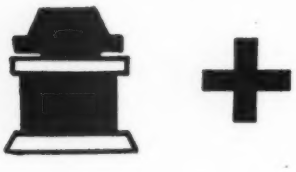
UNI-FORCE PLATFORM

. . . applies only vertical force components . . . assures full accuracy despite load placement or pile-up. No springs, knife edges or levers. Immune to side thrust.

WEIGHT TRANSDUCER

W-C Electrical Transducer can offer the broadest *net weight* output range . . . correspondingly higher accuracy.

W-C Pneumatic Transducer gives force-balance dependability . . . with independent tare adjustment. Unaffected by vibration. High sensitivity. Accuracy to 0.25% of range.



INSTRUMENTATION

Remote indication or fully automatic control of batch or continuous weighing . . . any material . . . any vessel or conveyor.

Write for descriptive literature.

W-C

WEIGHING *and Control* COMPONENTS, Inc.

64-F Fulmor Ave., Hatboro, Pa.

Report From Paris

WALDO WALLIS

SEVEN HUNDRED of France's engineers in private practice are members of the Chamber of Consulting Engineers, which, in turn, is a member of FIDIC, as the French call the International Federation of Consulting Engineers. There is also a forty-member body, "Syntec," bringing together large engineering firms.

CE exclusive

France has no "Order of Engineers," corresponding to its "Order of Architects." Chamber membership is sufficient guarantee of professional ability and standing.

The Chamber admits only French nationals or those who have been active in the French Union for at least 10 years. A member must have the required diplomas, five years of professional activity, and several instances of consultation as expert by the courts. He must not be a civil servant nor a salaried employee of an industrial or commercial firm. Correspondent members may be admitted, having met the registration requirements of their own country and having the ability and desire to render service to the Chamber.

The French consulting engineer, the *ingenieur-conseil,* exercises a profession characterized by its independence and its integrity and dignity. The French consulting engineer looks on the Chamber in a spirit of fraternity and deference. He is renumerated exclusively by his client. Fees cannot be lower than those fixed by the Chamber.

There are three current ways of establishing fees in France: first, a flat rate for the classic type of study; second, a sliding scale percentage; and third, a straight statement of engineer and staff time. The latter is customary on machinery development where the project involves complications impossible to estimate beforehand. The engineer's time is billed at from $4 to $10 an hour, that of chief draftsman or scale modeler from $3 to $4 per hour, the designing draftsman from $2 to $3 per hour, and the finishing draftsman from $1.75 to $2 per hour.

For fee calculations, engineering work is divided into two categories. The first includes street improvement, sewers, drainage, water distribution, simple bridges and dams, railways, highways, port and waterway improvement, tunneling for sewers or water mains, wharfs, reservoirs, pipelines, air compressors, and simple installations of pumps and condensers. The second category includes all special and more complicated projects such as mining, oil, metallurgical, and chemical installations, electric power generation and transmission, incinerating plants, water purification systems, complicated bridges and dams, complex level crossings, aerodynamic tunnels, complicated pumping stations, steam piping, and other pipelines.

Fees for projects in the first category range from 9 percent on projects of less than $85,000 to 5.33 percent on projects of $8,500,000. The rates for complicated work range from 13.5 percent on $85,000 or less to 6.43 percent on $8,500,000 or more. On projects for public works where the State is the client, the percentages, fixed in a circular of 1949, are less than those established for private clients. Also, certain work for moderate rent apartments in housing schemes was established in July, 1953, on a square meter basis.

The fees are based on the total cost of the project from beginning to end; including materials and labor (with social security benefits), the cost of new, used, or reused material, plus 40 percent for general expenses; excluding cost of land, purchase of legal rights, cost of work direction, and financing.

The French engineering firm engages in four types of work: (1) tentative project studies, followed by definite plans and estimates; (2) calls for bids and examination of tenders; (3) verification of builders' and contractors' plans; and (4) supervision of work, inspection, tests, and examination of claims. If the work of the engineering firm covers all four aspects, (1) is billed at 30 percent of the total (15 percent for

How electronics makes P-K exchangers better than ever

This man is expanding tube ends into the tube sheet—the "inner face" of a shell and tube heat exchanger that holds each tube in place. By doing it electronically, with the equipment you see here, the circumference of each tube is joined to the face of the exchanger with exactly the same pressure.

This minimizes the possibility of leaks developing—even when a mile of tubing and hundreds of tube ends are involved, as they are in many of P-K's special exchangers.

But fabricating procedures like these are only part of the story. Every P-K unit is "computed" for its thermal rating and design.

This automatic check of a unit's thermal rating is not only a safeguard, but can often save you money. And it allows P-K to give a full and complete guarantee that each unit will perform at its rated heating or cooling capacity.

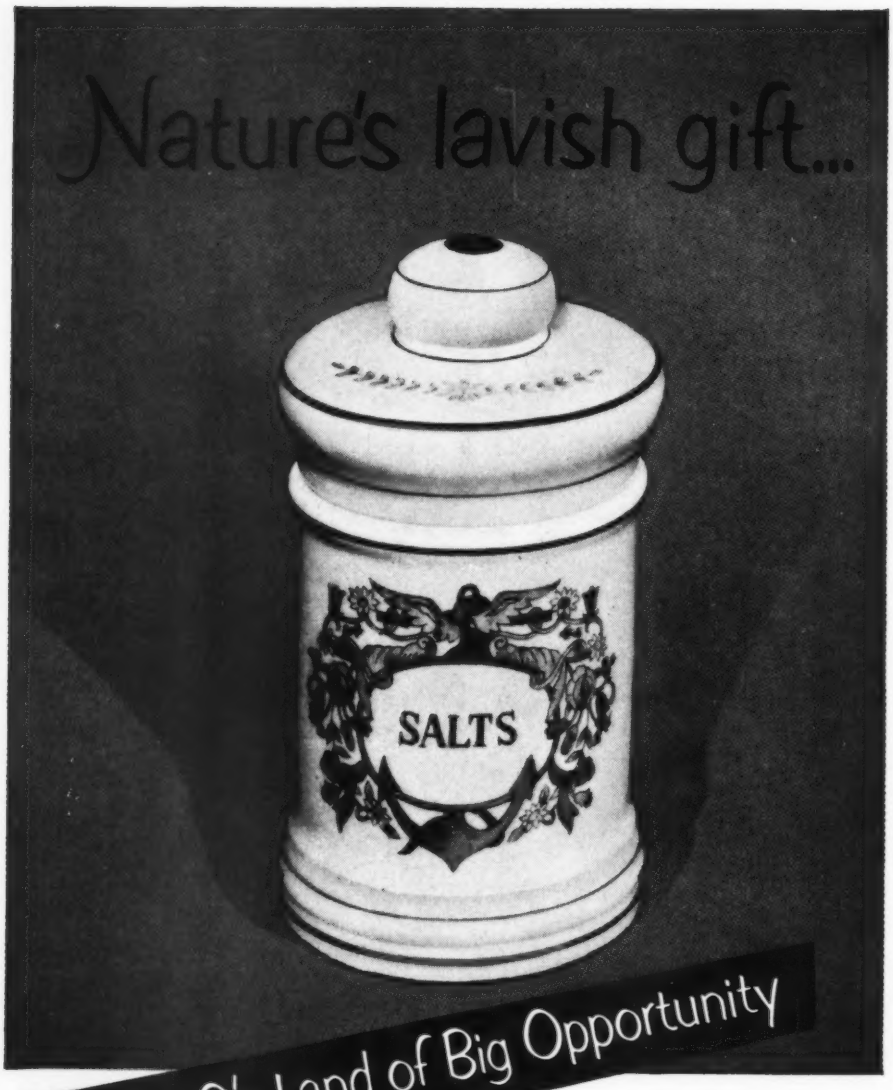
An increasing number of processors, engineers, and contractors have come to rely on P-K's painstaking fabrication and testing procedures —and their check, and double-check, of a unit's thermal rating. We would be pleased to design and build exchangers for you.

The Patterson-Kelley Co., Inc., 1760 Burson Street, East Stroudsburg, Penna. Offices in principal cities.

Patterson Kelley

Chemical and Process Division

Twin Shell Blenders • Autoclaves • Pilot Plants • Heat Exchangers • Ribbon and Double Cone Blenders • Lever Lock Doors



● Ohio Valley *rock* salt is the basic material for much of the chemical industry in the AMERICAN RUHR. Reserves of roundly 600 *billion* tons could supply the nation's needs for thousands of years. Too, vast natural brine reserves widen the range of salts available for modern chemical production.

Get the facts on production-right plant sites in this bountiful B&O area. See sites at your desk—airviews, and 3-dimensional color. *Ask our man!*

SPECIAL STUDY
"Look where a site is production-right"
ON REQUEST FROM
B&O RAILROAD
BALTIMORE 1, MD.

YOU CAN REACH HIM AT:
BALTIMORE 1 LExington 9-0400
NEW YORK 4 DIgby 4-1600 CINCINNATI 2 DUnbar 1-2900
PITTSBURGH 22 COurt 1-6220 CHICAGO 7 WAbash 2-2211

LINKING 13 GREAT STATES WITH THE NATION B&O

Baltimore & Ohio Railroad

Constantly *doing things*—better!

the tentative studies and 15 percent for the definite plans and estimates), (2) at 10 percent, (3) at 35 percent, and (4) at 25 percent. If the firm has charge of only a part of the work, the fee rate for each fraction is multiplied by a factor of 1.2.

Most of the large engineering firms are grouped in a professional organization called Syntec. These large firms employ researchers, technicians, draftsmen, and specialists on documentation. They maintain fully staffed laboratories. They give complete engineering services. There are no 25-story buildings in France occupied by a single firm (such as Ebasco in the U. S.), but Syntec member-firms are large enough to carry out complete missions, in a spirit of complete independence with, of course, no other fee than that of the client. The 38 members of Syntec, which is a noncommercial professional body, undertake industrial installations, studies of materials, and almost any other type of engineering work that the client may desire.

Two of the members, the Compagnie des Techniques Hydrauliques et Agricoles (COTHA), of Grenoble, and the Societe General d'Exportation Industriel (SOGEI), of Paris, have been designated for important work by the World Bank. SOGEI built the 100-meter arched dam, 40-meters high, at the falls of Saint-Geniez o Merle in France. with subterranean galleries and a 36,000-kw power plant. They also designed a dam and power plant at Enchanet, France, that supplies 210,000,000 kwh.

The Societe Anonyme Francaise d'Etude, de Gestion et d'Entreprise (SAFEGE), Paris, another member of Syntec, has developed a suspended air railway on inflated tires in collaboration with the Budd Company and Michelin; a new conception of public transport. This elevated railway will be nearly noiseless. Trials of inflated tires in the Paris subway proved that the idea is practical. The revolutionary feature of the "Silent Arrow" elevated line is that the wheels are on top.

Societe d'Etude et d'Entreprise Sederurgic handled engineering for the Paz del Rio wire drawing works from design inception to plant commissioning. In this, about fifty contractors participated. The steel mill is located in the tropics at an altitude of 2800 meters, necessitating a study of many special conditions.

These examples of work by French engineering firms show the diversity and scope of projects handled. ▲▲

L. TO R., H. HUGHES, H. P. DUFFILL, MR. & MRS. A. V. SAPH, W. E. BENNETT, MR. & MRS. V. MAYPER, MR. & MRS. B. L. NISHKIAN AND MRS. NISHKIAN, SR. ON STEPS GOING UP, MR. & MRS. I. E. BROOKE, MR. & MRS. F. M. HILL, AND MR. & MRS. G. C. McKINNEY.

BRITISH ASSOCIATION OF CONSULTING ENGINEERS HOSTS AMERICANS AT LUNCHEON IN ST. ERMINS HOTEL, LONDON.

U.S. Consultants Meet With British

On May 3 the group of American consulting engineers touring Europe under the auspices of CONSULTING ENGINEER attended their first official function — a luncheon given by the British Association of Consulting Engineers (Inc.). In the morning the group had been shown through the offices of the Institute of Civil Engineers by Col. W. K. Wallace, President of the Institute.

At the luncheon, the American consultants had an opportunity to exchange views with representatives of leading British consulting firms: J. S. Tritton, of Rendel, Palmer & Tritton, Chairman of the Association and President of the International Federation of Consulting Engineers; R. W. Mountain and B. Donkin, of Kennedy & Donkin; M. G. J. McHaffie, civil engineer; G. S. McDonald, of Sir Herbert Humphries & McDonald; R. W. H. Couzens, of Couzens & Brown; F. W. Slatter, of Fredk. S. Snow & Partners; J. T. Calvert, of John Taylor & Sons; D. M. Watson and H. D. Manning, of J. D. & D. M. Watson; L. Turner Esq., of Leslie Turner & Partners; G. A. R. Sheppard, of Binnie, Deacon & Gourley; T. A. Paton, of Sir Alexander Gibb & Partners; Sir Bruce White, of Sir Bruce White, Wolfe Barry & Partners; G. Kenyon Bell, of Wilton & Bell; J. Duvivier, of Lewis & Duvivier; J. R. Beard, of Merz and McLellan; J. Kennard, of Edward Sandeman, Kennard & Partners; J. S. Balfour, of D. Balfour & Sons; and Col. C. W. G. Walker, Sec'y, BACE.

Also present were F. E. Rogers, of the American Embassy; P. W. Ridley, representing the O.E.E.C. sponsored tour of European consultants to America; J. B. Pinkerton and R. Sharpe, of the British *Consulting Engineer* journal; and F. R. S. Yorke, representative of the Royal Institute of British Architects.

Each member of the tour was seated next to an Association member in the same field of engineering. After lunch, group members were taken individually to British consultants' offices for discussions.

The following day the group toured the offices of the Institute of Mechanical Engineers.

LEFT: J. S. TRITTON (IN FOREGROUND) AND G. C. McKINNEY. BELOW: HUNTER R. HUGHES, EDITOR OF CONSULTING ENGINEER AND SIR BRUCE WHITE.

News for the Consultant

ASME Revises Policy On Engineering Registration

The American Society of Mechanical Engineers, in support of the registration of professional engineers as being in the best interests of the engineering profession and the general public, has adopted the following revised policy:

¶ Approves in principle the Model Law and pledges to cooperate with other sponsoring groups in its revision subject to approval by the Council.

¶ Offers its facilities to assist in the appropriate revision or modification of registration acts in states where responsible organizations request assistance.

¶ Supports financially the activities of the National Council of State Boards of Engineering Examiners and gives advice and assistance to the Council when requested to do so.

¶ Recommends that there be no discrimination by implication, omission, or direction as to the form of business organization (individuals, partnerships, corporations, or others) under which the practice of engineering is conducted provided that the person or persons in responsible charge of such practice be legally registered professional engineers.

¶ Recommends that each Section appoint a standing committee known as the Registration Committee to cooperate with the State Registration Board and the Section Program Committee in the dissemination of information concerning registration.

¶ Recommends that each Section devote some time in a Section Meeting each year to the subject of engineering registration where, if possible, a member

BISON

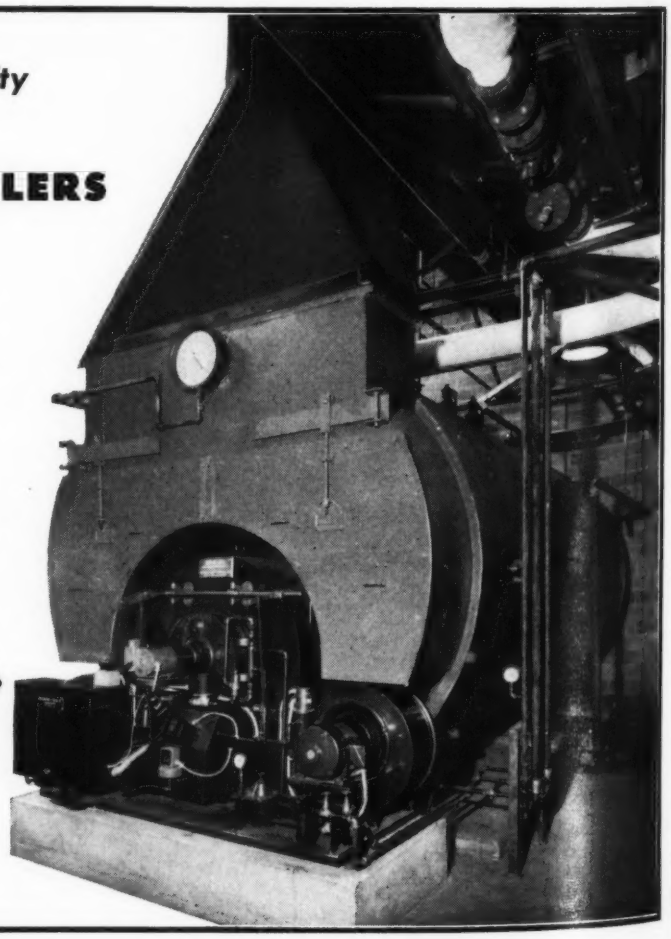
Dependable quality since 1863 . . . . .

POWER BOILERS

Throughout 93 years, Farrar & Trefts has been a leader in boiler design and construction. Today, as in yesteryear, F & T offers dependable, efficient, modern power boilers to satisfy the ever-increasing demands of institutional, apartment, office and industrial buildings. Under the same BISON brand, F & T also furnishes low-pressure boilers for heating purposes.

Proper selection of a boiler for the continuous delivery of required heat and power is a precise project, demanding the systematic approach of engineers long trained in this work. Engineers at F & T have this background of service and they welcome opportunities to evaluate the needs of boiler users.

Standard F & T Super Scot Power Boiler (150 lb. design pressure) with "Indiana Pack" burner at Mastic Asphalt Corp., South Bend, Ind. Furnished by Page Associates of Chicago. The Austin Co. were the Engineers and Contractors.



FARRAR & TREFTS DIVISION
ADSCO INDUSTRIES, INC.
20 MILBURN ST. BUFFALO 12, N. Y.

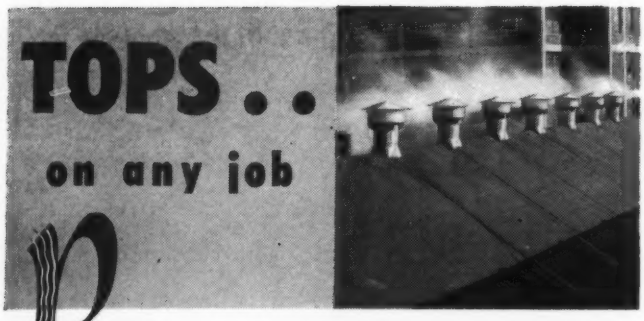
SPECIAL

Industrial and municipal turbine generator specialists give priority service up to 15,000 kw.

Worthington specialists in designing and manufacturing turbine generators up to 15,000 kw. are changing a lot of established buying ideas. Because they're not involved with building the huge central station turbine generators, Worthington engineers can give A-1 priority to every phase of design and manufacture of industrial and municipal units. They deliver a power package that has been completely tested, and adjustments made, to shorten installation time. They incorporate latest design advances in the turbine and generator, and finish the job with a streamlined heavy steel jacket to blend with the most modern power plant design.

When considering a turbine generator installation up to 15,000 kw., call on specialists in the field. Call your nearest Worthington District Office or write for Bulletin 1960C: Worthington Corporation, A&SP-Turbines, Harrison, N. J.

WORTHINGTON



TOPS . .
on any job

PENN VENTILATORS

. . complete range of units and sizes
for every ventilating problem . .

Shown above, the PENN AIRETTE, one of the many versatile roof ventilators available for supply or exhaust purposes.

When you specify Penn Ventilator — you're specifying satisfaction . . proven through countless installations.

Here is America's most complete line of Powered and Gravity Roof Ventilators attractively designed and efficient in performance. Your local Penn Ventilator man has full particulars and is qualified to work with you.

PENN VENTILATOR CO.

PHILADELPHIA 40, PA.

Representatives and Distributors in Principal Cities

Member of the Power Fan Manufacturers Association

In Eastern Canada: Air-Care, Ltd.
2125 Marcil Ave., Montreal 28, Que.

of the State Registration Board would address them.
¶ Recommends that, in states in which written examinations are required of applicants for registration, Sections cooperate with other groups in sponsoring refresher courses.
¶ Recommends that each Student Branch devote a session to engineering registration where, if possible, a member of the State Registration Board or a prominent registered professional engineer would address them, placing special emphasis on the purpose of registration, the standards required for registration, the Engineer-in-Training program, and the procedure for applying for registration.
¶ Requests its Engineers Registration Committee to arrange for the publication each year, preferably in the October or November issue of *Mechanical Engineering*, of an informative one-page article on the registration of professional engineers.

Bolts Prove Satisfactory For Railroad Bridges

High strength bolts have been found to be superior to rivets in some railroad structures, according to E. J. Ruble, head of steel, concrete, and timber structure research at the Association of American Railroads, speaking on "Recent Developments in Structural Research" at an Illinois Institute of Technology colloquium in May.

To disprove the contention that bolts capable of developing high clamping action would not stay tight when subjected to dynamic loads, an Armour Research Foundation research staff arranged to have about 2000 bolts installed in 15 different railroad bridges. Some of the bolts were installed in locations where considerable trouble had been encountered in keeping rivets tight, such as in lateral bracings, diaphragms between beams, stringer connections, floorbeam connections, and floorbeam hangers. The bolts have stayed tight for about eight years.

Other tests conducted on plain plates, and even plates with a hole, have indicated that the fatigue strength of the alloy steels is somewhat higher than that of carbon steel plates, although the increase in fatigue strength does not increase in proportion to the increase in yield strength of the alloy steels.

Tests on the various alloy steels when fabricated into joints and fastened with rivets have indicated that there is little difference in fatigue strengths. However, if the joints are fastened with high strength bolts, the fatigue strength of the alloy steel joints is considerably higher than that of joints fabricated of carbon steels.

Other investigations also have shown that the fatigue strength of structural joints fastened with cold driven rivets is considerably lower than those fastened with hot driven rivets.

Reporting on work done with different types of paints, Ruble pointed out that losses due to corrosion from brine drippings on railroad tracks and bridges amount to about $70 million per year.

In tests, various paints were used over different types of surfaces and it was found that a paint con-

HOME OFFICE BUILDING
MUTUAL BENEFIT LIFE INSURANCE CO. BUILDING, *Newark, N. J.*
ARCHITECT: *Eggers and Higgins, Architect*
CONTRACTOR: *George A. Fuller Co.*

KAWNEER METAL WALL *one responsibility from inception through installation*

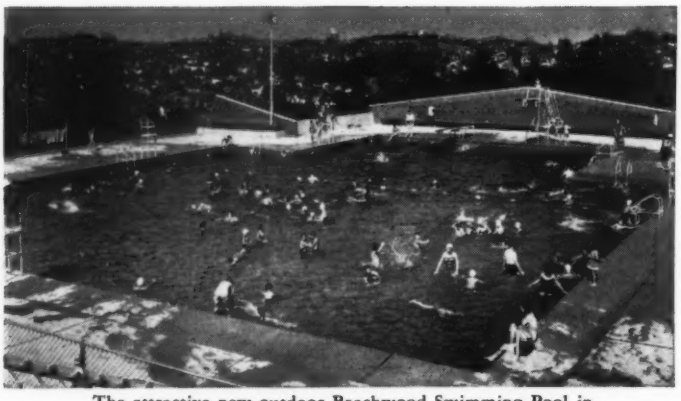
Other Kawneer metal wall jobs:

Tishman Buildings, *Los Angeles*
Equitable Life Building, *San Francisco*
Insurance Exchange Building *Oakland*
Imperial Oil Co., *Sarnia, Ontario*
Newark Center Building, *Newark*
Kaiser Aluminum, *Ravenswood, W. Va.*

The new Mutual Benefit Life building in Newark, N. J., is another outstanding example of Kawneer Metal Wall. Years of creative engineering and production in the field of architectural metals has culminated in a new service for architects . . . a new concept in metal wall construction. This building is an expression of Kawneer's ability to engineer a curtain wall to fit this architect's individual design. Kawneer accepts the complete responsibility for engineering, manufacturing and installation. Special weather-tightness features, adequate provision for expansion and contraction, and tested prefabrication methods assure the architect and contractor of complete client satisfaction. For further information write: Metal Wall Department, Kawneer, Niles, Michigan.

Write for folder describing Kawneer services and metal wall jobs.

50TH ANNIVERSARY
Kawneer
General Offices
NILES, MICHIGAN
ARCHITECTURAL PRODUCTS DIVISION
1906–1956



The attractive new outdoor Beachwood Swimming Pool in Pittsburgh, Pennsylvania is one of the finest examples of modern pool design. Its 328,000 gallon capacity is kept invitingly clear with Adams Poro-Stone Filters.

Another Modern Pool with ADAMS SPF Filters

Yes, here's another distinctive pool with the popular Adams Poro-Stone filters. And, there are some good reasons why more and more public pools are insisting on Adams.

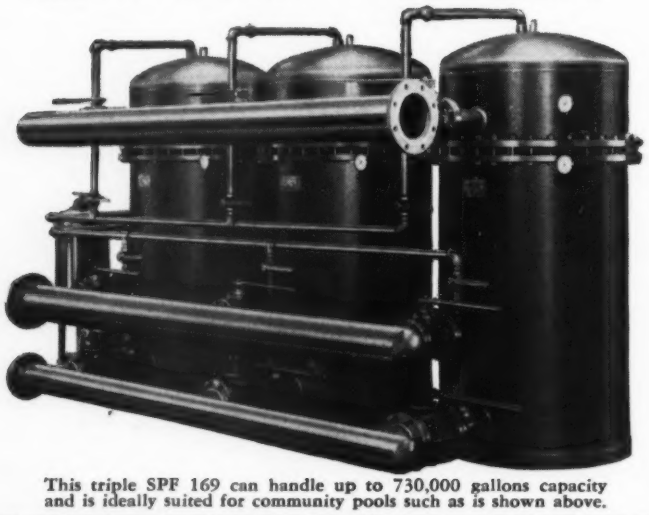
First, the exclusive ADAMS HI-FLOW backwash design gives you simple and easy cleaning . . . no messy disassembly . . . no scrubbing of filter elements. The high air dome and unrestricted backwash outlet provide complete purging of the filter tubes with high velocity water.

Second, rugged 4¼" O.D. PORO-STONE elements with nearly 40% open area are unaffected by corrosion. The first Adams swimming pool filter — in use since 1938 — was the first Poro-Stone Swimming Pool Filter installed in this country.

There are numerous other reasons why it pays to *specify* and *buy* Adams SPF filters. Get all the facts by writing for your copy of Bulletin 625. Use the handy coupon below.

R. P. ADAMS CO., INC.

256 EAST PARK DRIVE BUFFALO 17, N. Y.



This triple SPF 169 can handle up to 730,000 gallons capacity and is ideally suited for community pools such as is shown above.

R. P. ADAMS COMPANY, INC. JU-56

256 EAST PARK DRIVE, BUFFALO 17, N. Y.

Please send me by return mail your new Bulletin 625.

Name..... Title.....

Business.....

Street.....

City..... State.....

Size of pool is..... gallons.

sisting of 75 percent red lead with 25 percent iron oxide in the pigment, and a factor consisting of two parts linseed oil and one part alkyd solid, were superior to any of the other paints over a period of about four years. No paint was found that would perform satisfactorily on rusted surfaces.

Constitution for National Federation To Be Voted on July 6

The Consulting Engineers Association of Oklahoma will host the July 6, 7, and 8 meeting of the proposed National Federation of Associations of Consulting Engineers in Tulsa, at the Mayo Hotel. As agreed at the initial meeting in St. Louis in October, the Federation will be set up officially, its officers elected, and a final draft of the Constitution and By-laws voted on.

By the second week in May six of the ten founder associations had indicated their willingness to ratify the draft prepared by the Interim Steering Committee: Consulting Engineers Association of Oklahoma, Minnesota Association of Consulting Engineers, Consulting Engineers Association of California, New York Association of Consulting Engineers, The Association of Consulting Engineers of Upstate New York, and the Missouri Association of Consulting Engineers. The changes suggested by these groups are minor and are expected to be incorporated in the final draft before July 6.

Besides the ten founder associations, representatives of AICE, NSPE, AIA, ASME, AIEE, and ASCE have been invited to attend along with the editors of CONSULTING ENGINEER, *Architectural Record, Architectural Forum, Progressive Architecture, Mississippi Valley Contractor, Civil Engineering, New York Construction News, Inc.,* and *The American Engineer.*

Tentative agenda of the three day meeting will cover a debate on possible modifications of the Interim Steering Committee's draft of the Constitution and By-laws on the morning of the 6th. In the afternoon the draft will be presented for ratification and the Board of Directors elected. The Board will hold a public meeting on Saturday, and other business will be discussed on Sunday.

The four groups who had not voted to approve the draft by the time CONSULTING ENGINEER went to press are the Consulting Engineers Association of Colorado, Chicago Association of Consulting Engineers, Intermountain Institute of Consulting Engineers, Gulf Institute of Consulting Engineers.

European Engineers Visit the U. S.

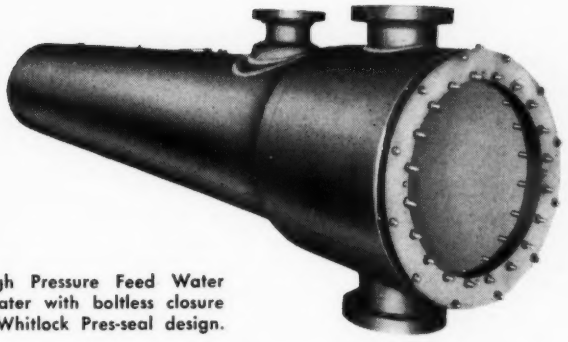
A group of consulting engineers from Europe is visiting this country to meet American consulting engineers and study the role played by them in the American economy. They are also interested in studying the organization, legal status, and type of work done by typical firms. The project is self-financed, and no U. S. funds are being used.

Participants in the tour were given an opportunity at the beginning of the project to read and discuss

Whitlock "Package"

SIMPLIFIES

Plant Planning

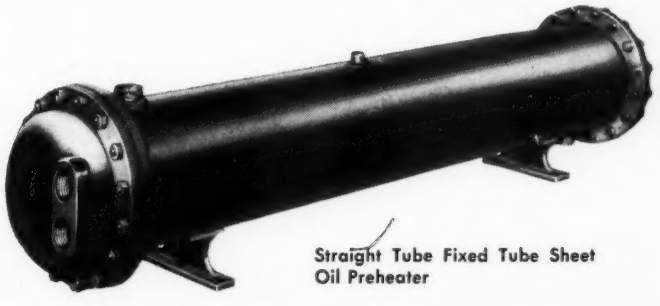


High Pressure Feed Water Heater with boltless closure — Whitlock Pres-seal design.

Whitlock's Heat Transfer "Package" includes a complete range of products.

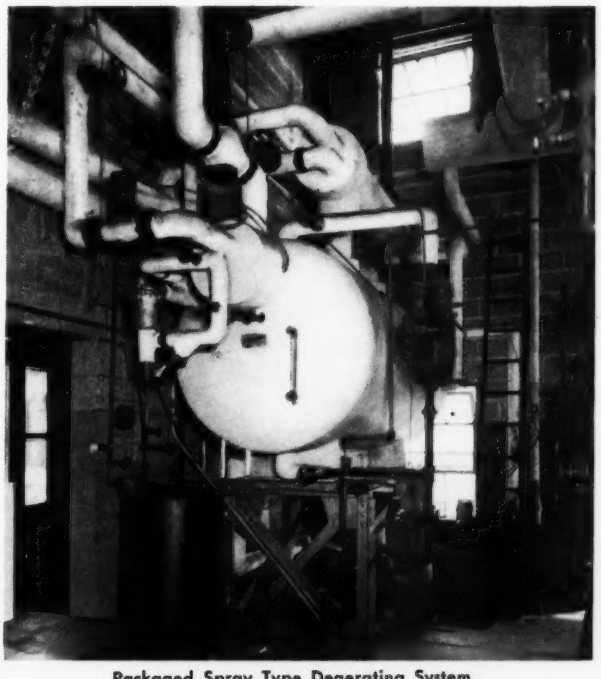
- **FEED WATER HEATERS**
- **FUEL OIL HEATERS**
- **CONVERTORS**
- **DEAERATING HEATERS**
- **SAMPLING COOLERS**
- **LUBE OIL COOLERS**
- **JACKET WATER COOLERS**
- **INSTANTANEOUS HEATERS**
- **STORAGE HEATERS**
- **REFRIGERATION EQUIPMENT**

Standard Two-Pass U-Tube Convertor



Straight Tube Fixed Tube Sheet Oil Preheater

Whitlock Engineers are quickly available to discuss any specific project with you. Write The Whitlock Manufacturing Co., **96** South Street, West Hartford 10, Conn. New York, Boston, Chicago, Philadelphia, Detroit, Richmond. Authorized representatives in other principal cities. In Canada: Darling Bros., Ltd., Montreal.



Packaged Spray Type Deaerating System complete with operating controls

Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.

the days of the
Divining Rod
are long past!
The latest techniques and a new scientific approach now solve the problems of ground water flow and infiltration. Our Hydrogeological Division can determine the dependable capacity of each Ranney horizontal water collector system prior to construction.
Why absorb costs and inefficient returns from your old water collecting operation? The RANNEY METHOD requires less personnel, cuts operating costs, and eliminates costly filter plants. . . . Write now!
Dept. CE-2
RANNEY
METHOD
Water Supplies Inc.
Water Supply Engineers and Contractors
841 Alton
Columbus 19, Ohio
Associate: Ranney Method Western Corporation

available literature on the subject and to confer with officials of the U. S. government, large banking institutions, and representative consulting engineers. In this initial phase such questions as the history of engineers in private practice in the United States, the number and size of firms currently operating, the types of taxation to which they are subject, and their legal status were explored.

On May 17 the group met with the New York Association of Consulting Engineers. On the 18th of June, the visitors will meet individually with consulting engineers to discuss particular interests.

The group plans to visit Chicago and have a meeting with the Chicago Association of Consulting Engineers on June 11.

Shortly before the end of the trip, there will be a meeting in Washington, on or about June 28, at which the visiting engineers will discuss the results of the tour. Plans are being made to have several of the members of the CONSULTING ENGINEER European Tour attend this meeting so that there can be an exchange of views between European engineers who have visited this country and American engineers who have recently visited Europe. This tour of the European consultants through this country is under the direction of Mr. N. E. Philpot and Mr. William J. Doremus, both of the International Cooperation Administration, U.S. Department of Commerce.

Cities Study Overhead And Underground Parking

With a view toward easing downtown traffic congestion and encouraging revitalization of the mid-city area, the Chamber of Commerce of Greater Philadelphia is considering a plan for construction of a combined heliport and parking facility for 40,000 cars by decking over a five-block stretch of the Schuylkill River.

The plan was conceived jointly by Walter C. Wagner, the Chamber's consulting engineer, and W. L. Travis, chairman of the aviation committee, and has the tentative approval of city officials.

On the river's west bank, the double-deck structure would extend over the planned Schuylkill Expressway and part of the Pennsylvania Railroad yards, in an area where the railroad has proposed construction of a sports stadium. On the east side it would extend over the Baltimore & Ohio Railroad tracks and an unoccupied area south of the Art Museum and the Benjamin Franklin Parkway.

Both parking and heliport areas would have entrances on both sides of the river, at the ends of some dozen streets that now run either to the river or to the railroad tracks. Clearance would be equal to that of present bridges over the river — from 38 to 44 ft.

According to Wagner, construction costs would be less than for a bridge since surfaces would not be subject to heavy vibration from fast-moving vehicles. He predicted parking fees probably would pay for the entire cost.

The text is continued on page 78.

Answers FOR THE ENGINEER

SUPERIOR STEAM GENERATORS

What Are the Advantages of Down-Draft Multi-Pass Design?

Dry Steam

Absence of surging is the best assurance of dry steam production. The 4-pass down draft design of Superior Steam Generators places the hottest gases of the first and second passes directly below the steam releasing surface for the entire width of shell, thus avoiding the excessive surging which takes place when concentrated steam rises through the water from the bottom of the drum.

Improved Circulation

The proportional distribution of gases, possible only with multi-4-pass design, provides higher velocity circulation eliminating sludge accumulation.

Maximum Heat Transfer

The combined length of the four successive passes of Superior Steam Generators provides maximum heat transfer by maintaining high gas velocities. 4-pass design reduces tube volume in successive passes, thereby maintaining the scrubbing action of the hot gases, and further promoting maximum heat transfer.

Quick Steaming— Equalized Expansion

As shown in the illustration, the 4-pass design with a gas pass between the integral furnace and the bottom of the boiler shell, provides the dual functions of quick steaming and equalized expansion without strain on the main welded seam.

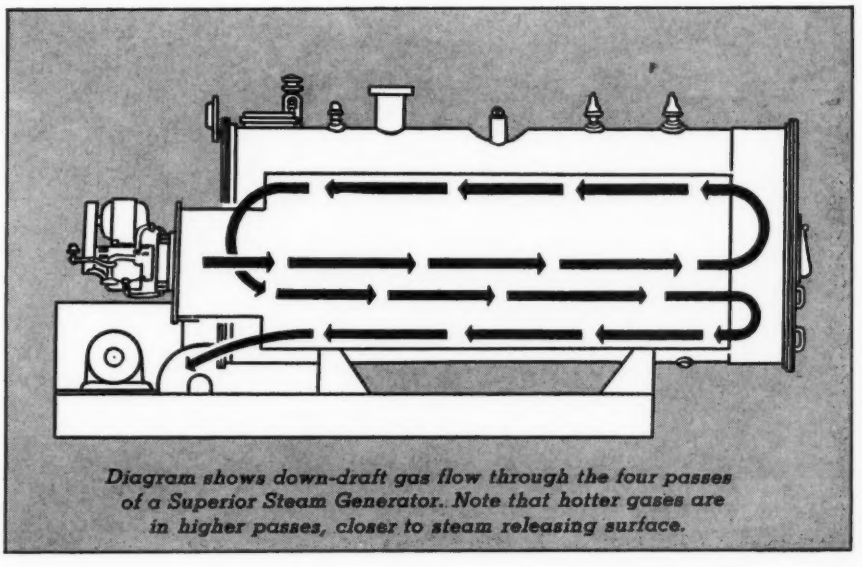
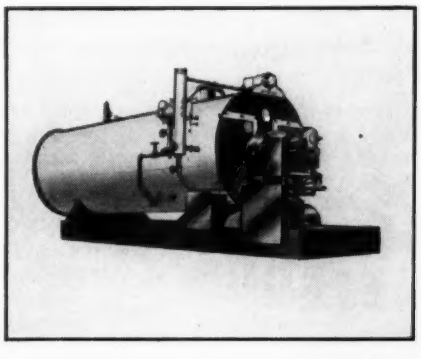


Diagram shows down-draft gas flow through the four passes of a Superior Steam Generator. Note that hotter gases are in higher passes, closer to steam releasing surface.

WRITE TODAY FOR A COPY OF THE CATALOG . . .

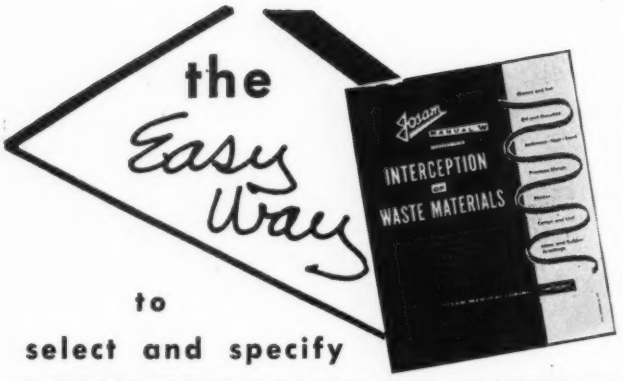


. . . which explains in detail with illustrations the many design features which bring minimum installation, maintenance and operating costs, plus maximum efficiency and long life to owners of Superior Steam Generators. For complete details on units in 18 sizes from 20 to 600 b.h.p. for pressures to 250 p.s.i. burning oil or gas or both, write today for Catalog 807.

Specialists in PACKAGED BOILERS . . . exclusively

SUPERIOR COMBUSTION INDUSTRIES INC.
TIMES TOWER, TIMES SQUARE, NEW YORK 36, N.Y.

SUPERIOR STEAM GENERATORS



select and specify

INTERCEPTORS FOR WASTE MATERIALS

Josam MANUAL "W"

Save time and avoid error in selecting and specifying interceptors to eliminate all types of waste materials from plumbing drainage systems. New Josam Manual "W" has complete and authoritative data on the application, installation, sizing and operation of a wide range of interceptors to solve waste problems in all types of buildings. Write for your free copy today.

THE JOSAM LINE INCLUDES:

Floor, Roof and Shower Drains; Backwater Valves; Shock Absorbers for Pipe Lines; Interceptors for Grease, Oil, Hair, Sediment and Plaster; Swimming Pool Fittings.

JOSAM MANUFACTURING CO.

Dept. C.E.
Michigan City, Indiana

Aget offers more! Over 38 standard Dustkop models to choose from . . . *Plus* engineering service to help you select, provide, and install the proper accessories and fittings to complete your dust collecting system. Write for illustrated folder . . . Today!

AGET MANUFACTURING COMPANY
1376 E. CHURCH STREET • ADRIAN, MICHIGAN

While Philadelphia considers the possibility of utilizing space over the river, Columbus, Ohio, is planning to park cars underground. The Ohio Underground Parking Commission has before it preliminary sketches of four alternative plans for a garage under the Statehouse grounds.

The proposals provide parking facilities for from 1100 to 1213 cars. Final size will depend on a traffic and revenue survey prepared by Wilbur Smith and Associates, New Haven, Conn., and a possible decision to add another level and reserve a large surface area for future expansion.

The H. K. Ferguson Company has been retained to prepare the design and make a cost survey.

MIT Offers Short Summer Course For Practicing Structurals

To assist practicing structural engineers to develop and improve their knowledge in the field of dynamic loading, the Massachusetts Institute of Technology is offering a two-week special summer course "Structural Design for Dynamic Loads," August 6 through 17.

The program is planned for structurals with experience in design for dynamic loadings and for those who have been engaged primarily in designing for static loadings. Dr. Charles H. Norris, Professor of Structural Engineering at MIT will direct the program. Special guest lecturers will include Professor John K. Minami, of Waseda University, Tokyo, Japan, and Dr. Yuan-Chiu Loh, Principal Research Engineer, Scientific Laboratories, Ford Motor Co.

Information is available from the Summer Session Office, Room 7-103, MIT, Cambridge 39, Mass.

New Engineering Group Holds First Annual Meeting

A year after its inception in May of 1955, the Food Facilities Engineering Society held its First Annual Meeting in Chicago last month. The group is made up of consulting engineers specializing in the food facilities field. (See p. 34, this issue of CE.)

Major business of the meeting was amendment of the constitutional by-laws regarding membership. The requirement of one year of consulting experience to qualify as a regular member has been increased to two years, and the by-law has been broadened to include other members of food facilities firms besides owners. One year as a consultant qualifies an engineer as an associate member. This is in addition to ten years in the food facilities field. A professor, teacher, or instructor in a college or university of recognized standing may become an educational member if the major portion of his time is devoted to teaching in this field.

All officers were re-elected for a second year: Fred Schmid as president and treasurer; John W. Hargrave, vice president; and N. Bert Persson, secretary. ▲▲

SPEEDLINE FITTINGS MAKE THE DIFFERENCE AT WYETH!

"Hard to hold" process solvents and penicillin broth posed a vital piping problem for plant engineers at the Wyeth Antibiotic Laboratory, in West Chester, Pa. Then Wyeth engineers got the complete story on Speedline Fittings, especially designed for Schedules 5 and 10 stainless steel process piping installations. The result? No leakage problems after more than three years' continuous plant operation with a Speedline piping system . . . substantial savings in piping installation time and costs!

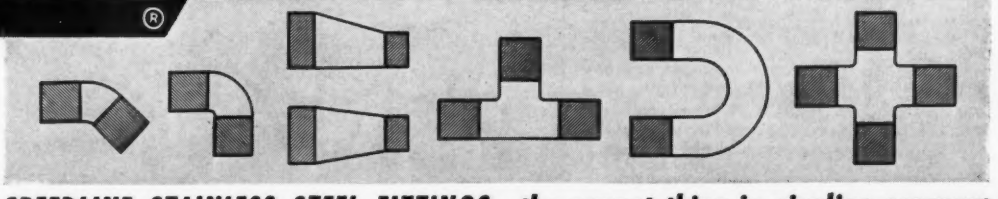
Unique features of Speedline Stainless Steel Fittings permitted easier, faster assembly of leak-proof joints at every phase of this complicated piping layout. Speedline Aligning Connectors allowed "in place" pre-assembly for alignment prior to welding. Speedline's exclusive "tangential feature"—the additional straight section on every end of every formed fitting—permitted maximum clearance for welding with or without connectors . . . allowed direct attachment of flanges to fittings for valve installations even in the most confined areas. Design hours were saved, assembly time reduced . . . and total costs lowered.

If leakage is a problem in your process operations . . . or if greater design flexibility and economy could improve your process piping installations . . . why not get the complete story on Speedline Fittings for yourself. It's available in a fully illustrated catalog, yours at no obligation. Write for a copy today.

Speedline®

SPEEDLINE DISTRIBUTORS ARE LOCATED IN PRINCIPAL CITIES FROM COAST TO COAST

Write for a copy of "Speedline Fittings"... without obligation.



®REG. TM **SPEEDLINE STAINLESS STEEL FITTINGS—the newest thing in pipeline economy**

Manufactured by **HORACE T. POTTS COMPANY** • 522 E. Erie Avenue • Phila. 34, Penna.

for INDUSTRIAL and AIR CONDITIONING SERVICE . . .

Phillie Gear *standardized*

HI-SPEED REDUCER / INCREASER

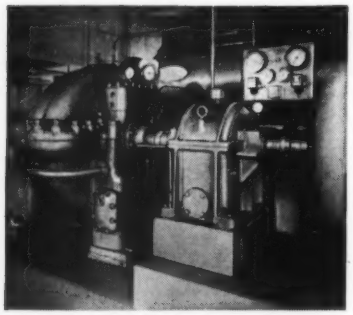
These modern, ruggedly-built Standardized Units contain all the features and advantages of custom-built units; being specially designed for *increaser or reducer applications*—where rotating speeds range as high as 9000 r.p.m., or pitch line velocities up to 10,000 feet per minute.

Phillie Gear Hi-Speed Units meet the current trend toward higher prime-mover speeds of steam turbines, ultra high speed electric motors, or internal combustion engines—for driving Compressors, Pumps, etc. at *reduced speeds*, or the *increased speed* required for driving many Pumps, Compressors, Fans and Generators.

All helical gears and shafts are dynamically balanced to give the ultimate in vibration-free power transmission.

These Hi-Speed Units are available for horsepowers from 1 to 7,100; ratios 1:1 to 10:1, for either speed increasing or speed reducing.

Send for Catalog HI-55.



A Phillie Gear HI-SPEED Air Conditioning Drive Installation, Sears Roebuck Co., Pittsburgh, Pa. Input 342 HP with 1:3.56 Increase, Output speed 6230 RPM

phillie gear

PHILADELPHIA GEAR WORKS, INC.
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.
Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS
LIMITORQUE VALVE CONTROLS
FLUID AGITATORS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

MEN IN ENGINEERING

The St. Joseph Valley section of the American Society of Mechanical Engineers has named Cecil W. Armstrong as "Outstanding Engineer of the Year." He is head of the firm of Cecil W. Armstrong & Associates, of Warsaw, Ind.

Maj. Gen. Louis W. Prentiss (U. S. A. Ret.) has assumed the post of executive vice president of the American Road Builders' Association. He was formerly in command of the Engineer Center, Ft. Belvoir, Va.

Sidney W. Barbanel, Consulting Engineer, has moved his offices to 29-46 Northern Blvd., Long Island City, N. Y.

Carl E. Smith, head of Carl E. Smith Consulting Radio Engineers, of Cleveland, Ohio, has been made a Fellow of the American Institute of Electrical Engineers for his contributions to broadcasting antenna design, military electronics, and electrical engineering education.

Battelle Memorial Institute has established a Systems Engineering Division for research in the develop-

But did you know...

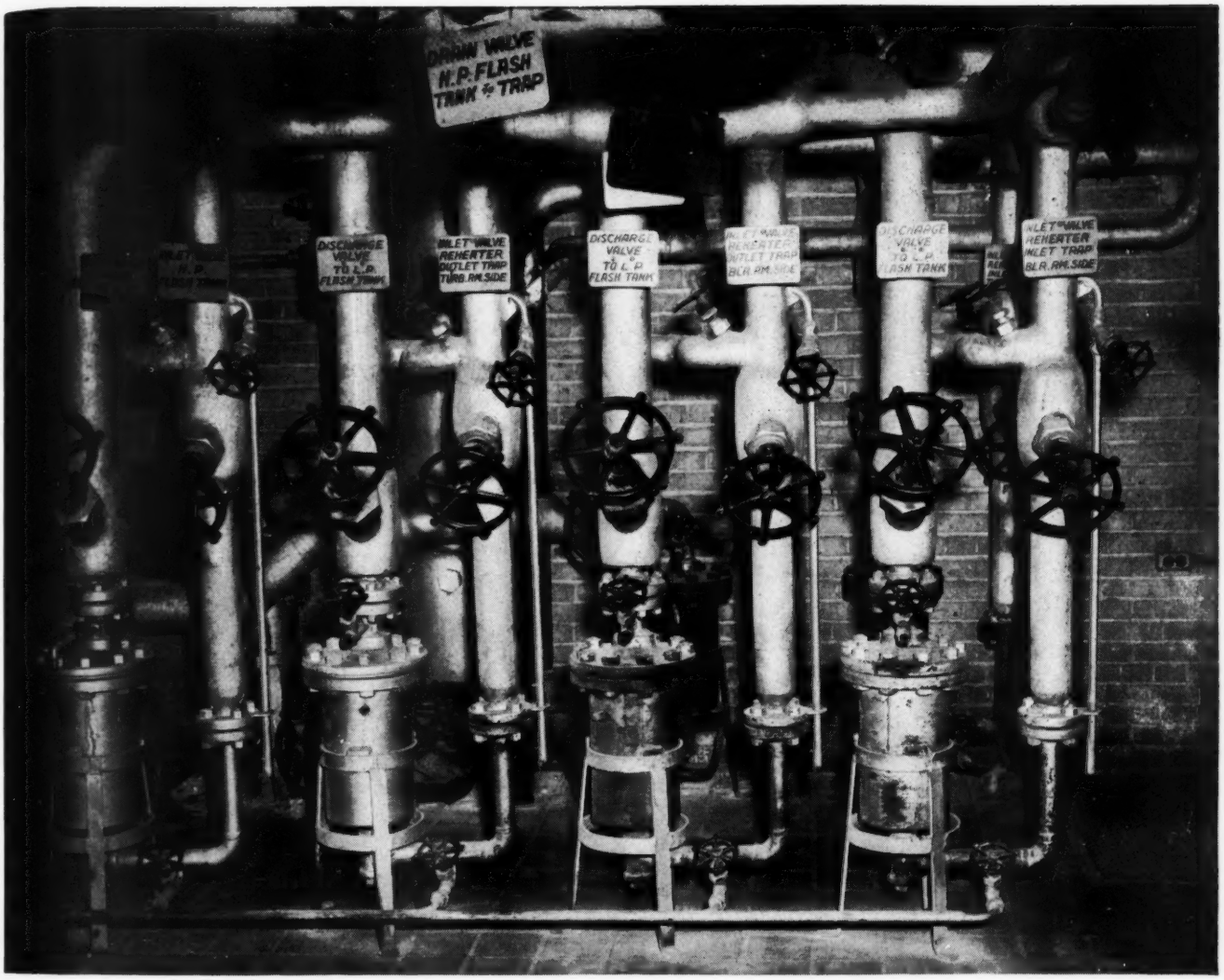
GOLDEN-ANDERSON also makes these other Fine-Quality Valves

• SURGE RELIEF • PRESSURE REDUCING
• SWING CHECK • ELECTRIC CHECK • FLOAT
• SOLENOID • FLOWTROL

All of above are available in either ANGLE or GLOBE body design in sizes 2" through 36".
Write for technical bulletins.

GOLDEN ANDERSON Valve Specialty Company
1281 RIDGE AVE., PITTSBURGH 33, PA.

Designers and Manufacturers of VALVES FOR AUTOMATION


DRAIN VALVE
H.P. FLASH
TANK & TRAP
DISCHARGE VALVE TO L.P. FLASH TANK
INLET VALVE REHEATER OUTLET TRAP TURB. RM. SIDE
DISCHARGE VALVE TO L.P. FLASH TANK
INLET VALVE REHEATER OUTLET TRAP BLR. RM. SIDE
DISCHARGE VALVE TO L.P. FLASH TANK
INLET VALVE REHEATER INLET TRAP BLR. RM. SIDE

"Panel" of Eleven says Traps are Best for draining Superheated Steam Lines

. . . AND THESE PLANTS AGREE

Typical Armstrong high pressure trap users:

Consumers Power Company—Comstock, Erie, Essexville, Muskegon, Zelwaukee, Michigan

Ohio Power Company, Philo, Ohio

Kansas City Power & Light—Kansas City, Mo.

Georgia Power Company—Yates, Macon, McManus, Georgia

United Illuminating Company—New Haven, Conn.

Philadelphia Gas & Electric—Philadelphia, Pa.

San Diego Gas & Electric—San Diego, Calif.

Wisconsin Electric Power Company, Milwaukee, Wisconsin

Northern States Power Company—St. Paul, Granite Falls, Black Dog, Minn.

Cincinnati Gas & Electric Company, Cincinnati, Ohio

One of the readers of a power plant publication recently asked, "which is the best device for removing condensate from lines carrying superheated steam . . ."

Eleven readers answerd this published question. *All* agreed, from experience, that steam traps are best.

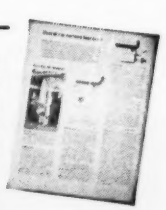
Traps are automatic. Traps prevent steam loss. Traps take care of boiler carryover. Traps are available with sufficient capacity to take care of any condensate load. Traps don't "forget" to drain the lines.

Since 1929, Armstrong inverted bucket forged steel steam traps have kept pace with the trend to higher steam pressures. Today, they are widely recognized as essential safety devices in leading power plants throughout the world operating at pressures up to 2400 psig.

For safe, dependable drainage of superheated steam lines, get the facts about Armstrong traps. Call your local Armstrong Representative or write Armstrong Machine Works, 965 Maple St., Three Rivers, Michigan.

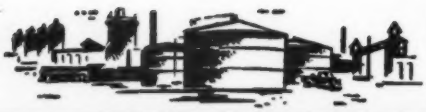
ASK FOR REPRINT—

"Should We Trap Superheated Steam Lines"—tells the experience of trap users... answers your questions on high pressure trapping. Ask for Catalog J, too . . . complete data on Armstrong forged steel traps. Free on request—no obligation.



Application Engineered

ARMSTRONG STEAM TRAPS



Use SAFETY GRIP-STRUT grating

Wherever a safe footing is required

Grip-Strut circular stairway on Shell Oil tank in Portland, Ore.

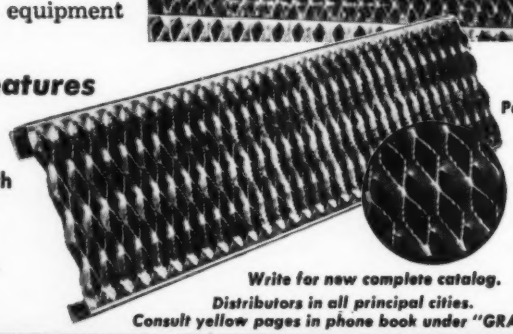
See how Shell Oil uses Grip-Strut for a safe ramp between tanks.

View looking down circular stairway on Shell Oil tank shown above.

SAFETY GRIP-STRUT is the new basic material, all in one piece (including channels), not welded, riveted or expanded in steel or aluminum, in standard sizes and gauges. Safety GRIP-STRUT presents an open space, in a diamond pattern, in excess of 55% of the area for ready access of light and air and gives a positive NON-SKID footing in all directions. Ideal for work platforms, stair and ladder steps, flooring, balconies, catwalks, machinery guards, fire escapes and for original equipment safety treads.

Important Safety Features

- ★ Fire proof
- ★ Slip proof
- ★ Maximum strength
- ★ Minimum weight
- ★ Easy to stand on
- ★ Cool in summer—warm in winter



Pat. Pending

Write for new complete catalog.
Distributors in all principal cities.
Consult yellow pages in phone book under "GRATING"

GRIP-STRUT division
THE GLOBE COMPANY • *Manufacturers since 1914*
4026 S. PRINCETON AVE. • CHICAGO 9, ILL.

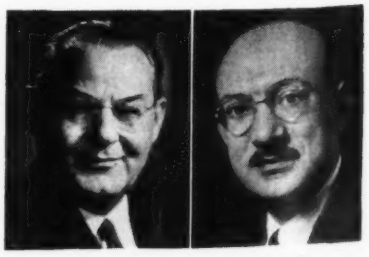
ment and design of automatic processing and control systems. Joseph J. Stone is chief of the newly formed division.

New York associate of the consulting engineering firm of Fred S. Dubin Associates is Frederick C. Lowy.

President Eisenhower is shown receiving a certificate of honorary membership in the American Society of Mechanical Engineers from Joseph W. Barker, president of ASME. The honor is for "acknowledged professional eminence in the field of engineering."

John Thomas Reid has been named research manager of The American Society of Mechanical Engineers. His duties will include staff service for the society's various research committees, co-ordination and assistance in fund-raising for research projects, and liaison with the Engineering Foundation and the National Research Council.

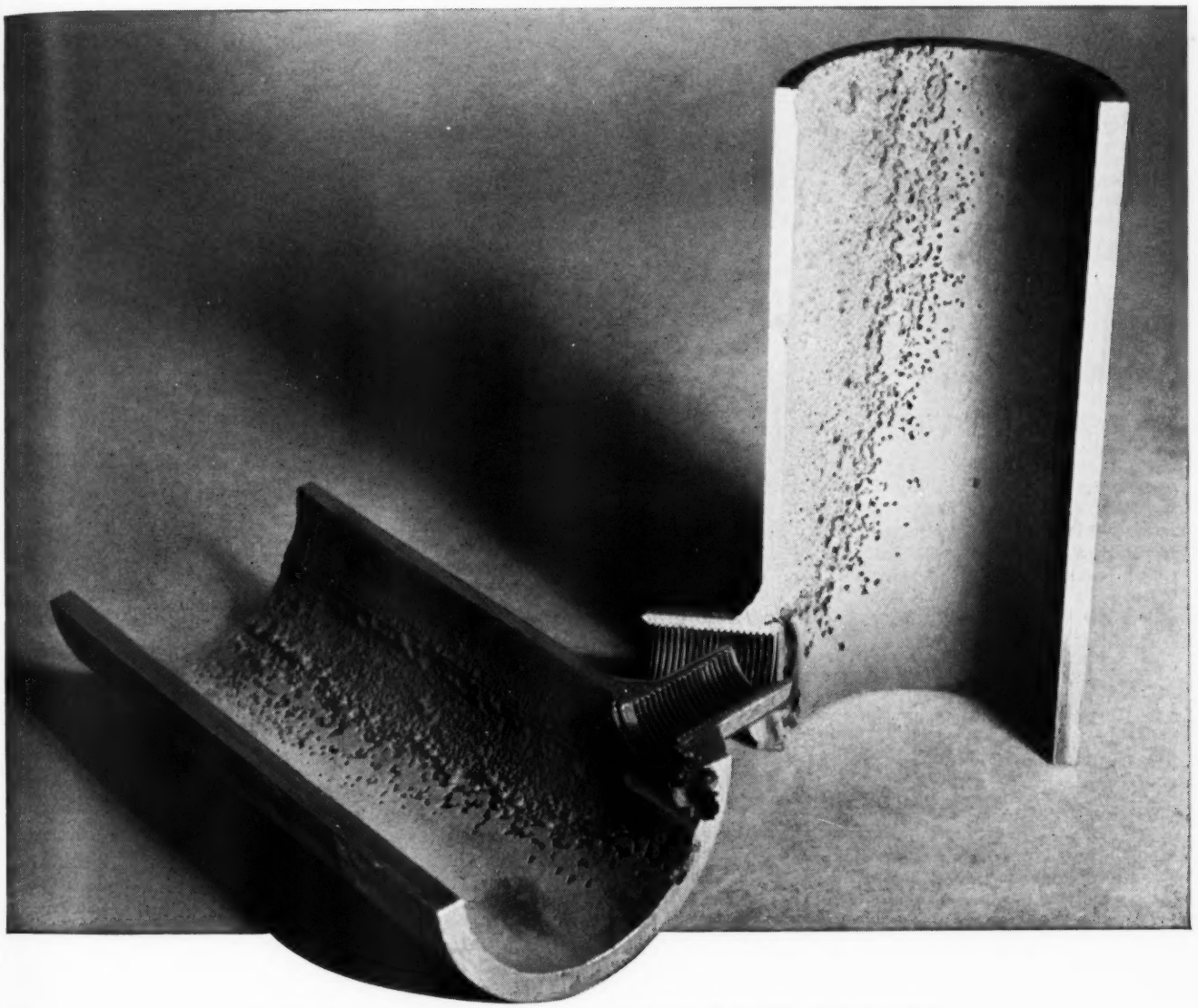
At Albert Kahn Associated Architects and Engineers, Inc., G. S. Whittaker has been elected to the board of directors to fill a vacancy created by the death of O. L. Canfield. Geo. H. Miehls, re-elected president of the firm, was also made chairman of the board, a newly created post.



MIEHLS FELD

Dr. Jacob Feld, consulting engineer for design and supervision of the foundation and structural work of the new New York Coliseum, has been named "Metropolitan Civil Engineer of the Year 1955" by the New York Metropolitan Section of the American Society of Civil Engineers.

Paul T. W. Strub has joined the Fluor Corporation, Ltd. as assistant to J. S. Fluor, president.



PIT-POCKED PICKPOCKET

In power-demanding industries, pitted pipe means out-of-pocket expense. The annual losses in labor and materials to replace equipment damaged by cavitation and corrosion reach staggering proportions.

The corrosive attack against this pipe was accelerated by mechanical action. Cold water injected into a high-pressure condensate return line caused steam collapse, resulting in violent hammering and cavitation-erosion damage. Because shock forces disrupted protective films on the interior surface of the pipe, failure occurred rapidly in this short section.

Dearborn Engineers spotted the cavitation problem, and recommended design changes which eliminated the trouble. Thereafter the entire return line system was fully protected by Filmeen.*

Dearborn Filmeen, a concentrated amine treatment, forms a continuous corrosion-inhibiting barrier between condensate and metal. This non-wettable film protects against both carbonic acid and oxygen corrosion. Filmeen readily disperses in hot condensate, permitting continuous feed direct to boiler or steam system.

Take advantage of Dearborn's Water Treatment and Engineering "know-how." Your Dearborn Representative will demonstrate Filmeen's efficiency in combatting destructive corrosion. He will survey your system and recommend control measures and feeding arrangements best suited to your plant requirements. The coupon will bring full details.

**FILMEEN—U.S. Pat. No. RE-23614 reserves to Dearborn Chemical Company and its licensees exclusive right to the use of octadecylamine for water treatment.*

Dearborn®

combatting corrosion wherever it occurs

Dearborn Chemical Company
Merchandise Mart Plaza, Dept. CE
Chicago 54, Ill.

☐ Have a representative call.

☐ Send me more information on Dearborn Filmeen Water Treatment Service.

Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

NEED BULK STORAGE NOW?

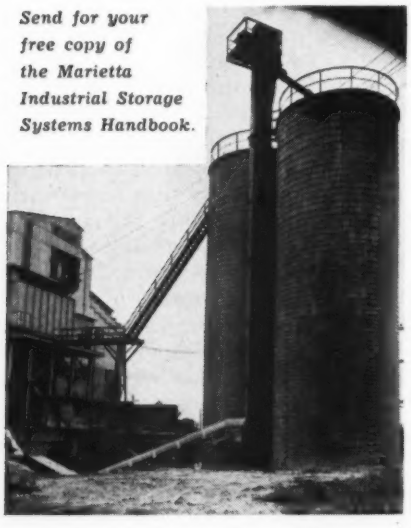
SEE MARIETTA

Marietta concrete silos can solve your storage problems quickly, economically and efficiently. Whatever your needs Marietta will design the system to meet your requirements. Trained crews handle the erection from the ground up in the shortest possible time. There are NEVER ANY DELAYS due to critical material shortages.

Sturdy air-cell or solid concrete stave construction holds materials in safe, dry storage. Mechanical or pneumatic operated conveyors, feeders and discharge systems can be mounted on top or side walls.

Call in Marietta now. See how quickly you can end material wastes and handling costs . . . improve plant production and appearance with an efficient Marietta Storage System.

Send for your free copy of the Marietta Industrial Storage Systems Handbook.



The Marietta 40 YEARS OF LEADERSHIP AND SERVICE

Marietta

CONCRETE CORPORATION
Marietta, Ohio

BRANCH OFFICES: Baltimore 21, Md., Charlotte 6, N.C., Nashville, Tenn., Jamestown, N.Y.

Notes FROM ABROAD

Newsprint for Asia

India has opened officially its first mill to manufacture newsprint. The $12 million project is the first such mill on the mainland of Asia and the only modern installation designed to produce newsprint from bamboo and salai trees. Previously, Indian newspapers imported their paper from Canada or Scandinavia, and school books were printed in other countries.

Ebasco Services, Inc. designed and supervised construction of the project, which includes groundwood and chemical pulp and paper machine divisions, storage and shipping buildings, and work shops.

Reinforcing by Machine

A new machine developed in England expedites laying of reinforced concrete paving for roads and airfield runways. It consists of a series of prongs or skids that place fabric reinforcement in the concrete, allowing the correct amount of cover. The machine

EXTRA YEARS

OF MORE DEPENDABLE POWER and at less cost per pound of steam

TODD BURNERS

GAS OR OIL

PRODUCTS DIVISION

TODD SHIPYARDS CORPORATION

HEADQUARTERS:
Columbia & Halleck Streets, Brooklyn 31, N. Y.

PLANT:
Green's Bayou, Houston 15, Texas

TODD NEW YORK, U.S.A.

BIFURCATOR® FAN

key to your corrosive fume removal problems

BIFURCATOR is the divided-housing fan backed by 30 years experience in design and application.

Ideal for corrosive, high temperature and hazardous fume removal from:

CERAMIC KILNS
CERAMIC PLANT INSTALLATIONS
CHEMICAL PLANT INSTALLATIONS
CHEMICAL LABORATORY HOODS
CORE BAKING OVENS
DRYING OVENS
DYE HOUSES
ELECTROPLATING TANKS
FOOD PROCESSING OVENS
FOUNDRIES — POURING AREAS
FOUNDRIES — SHAKE-OUT AREAS
FURNACES
GLASS PLANTS
LITHOGRAPHIC OVENS
LUMBER DRYING KILNS
METALLURGICAL PLANTS
METAL PICKLING VATS
PAPER MILLS
SLASHERS
STRIPPING TANKS
TEXTILE MILLS

De Bothezat FANS

A DIVISION OF

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

Mail coupon today for free Catalog DB-37-55.

DeBOTHEZAT FANS DIVISION, Dept. COE-656
American Machine and Metals, Inc.
East Moline, Illinois

☐ Send Bulletin DB-37-55 containing complete data on the Bifurcator for exhausting fumes.

☐ Have a DeBothezat representative call.

COMPANY

ADDRESS

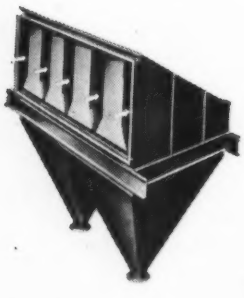
CITY ZONE STATE

ATTENTION MR.

Your plant and equipment suffers . . . your community goodwill fades away. These problems can be solved. Prat-Daniel Collectors are designed for the control of industrial dusts and flyash. Multiple small diameter tubes provide powerful centrifugal forces, resulting in sustained high collection efficiency . . . even with ultra-fine dusts.

Whether the problem is industrial dust or flyash, you are assured of satisfaction with P-D Collector Systems, engineered to meet your specific needs.

Write for Reprint No. 102 titled, "What Type Collector?"



pd

Project Engineers
THE THERMIX CORPORATION
GREENWICH, CONN.
(Offices in 38 Principal Cities)
Canadian Affiliates: T. C. CHOWN, LTD., Montreal 25, Que.

Designers and Manufacturers
PRAT-DANIEL CORPORATION
SOUTH NORWALK, CONN.
POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

runs on rails and is attached to the concrete spreader. Its use makes stirrups and spacers unnecessary since the full depth of concrete is laid in one operation.

Lightweight Concrete

A Dutch factory will begin production, under license, this summer of a new Swedish Durox concrete, which is far lighter than ordinary concrete. Blocks, slabs, and wall and roof elements will be produced by the plant.

Cold Weather Construction

The West German government's experimental winter construction program at 17 selected sites has proved housing construction feasible with temperatures down to —22 F. Maximum winter temperature for efficient construction was found to be about 19 F. The government now hopes to proceed with construction during the entire year.

Compressed Air Calms Surf

In the harbor of Heligoland, Germany, a device has been installed to calm the surf and tides with the use of compressed air. From a perforated pipeline installed on the sea bottom compressed air escapes, rising to the surface of the water as a "veil" of small bubbles. It is claimed that the air veil calms the surf to the extent that ships anchored behind the veil can load and discharge cargo in safety.

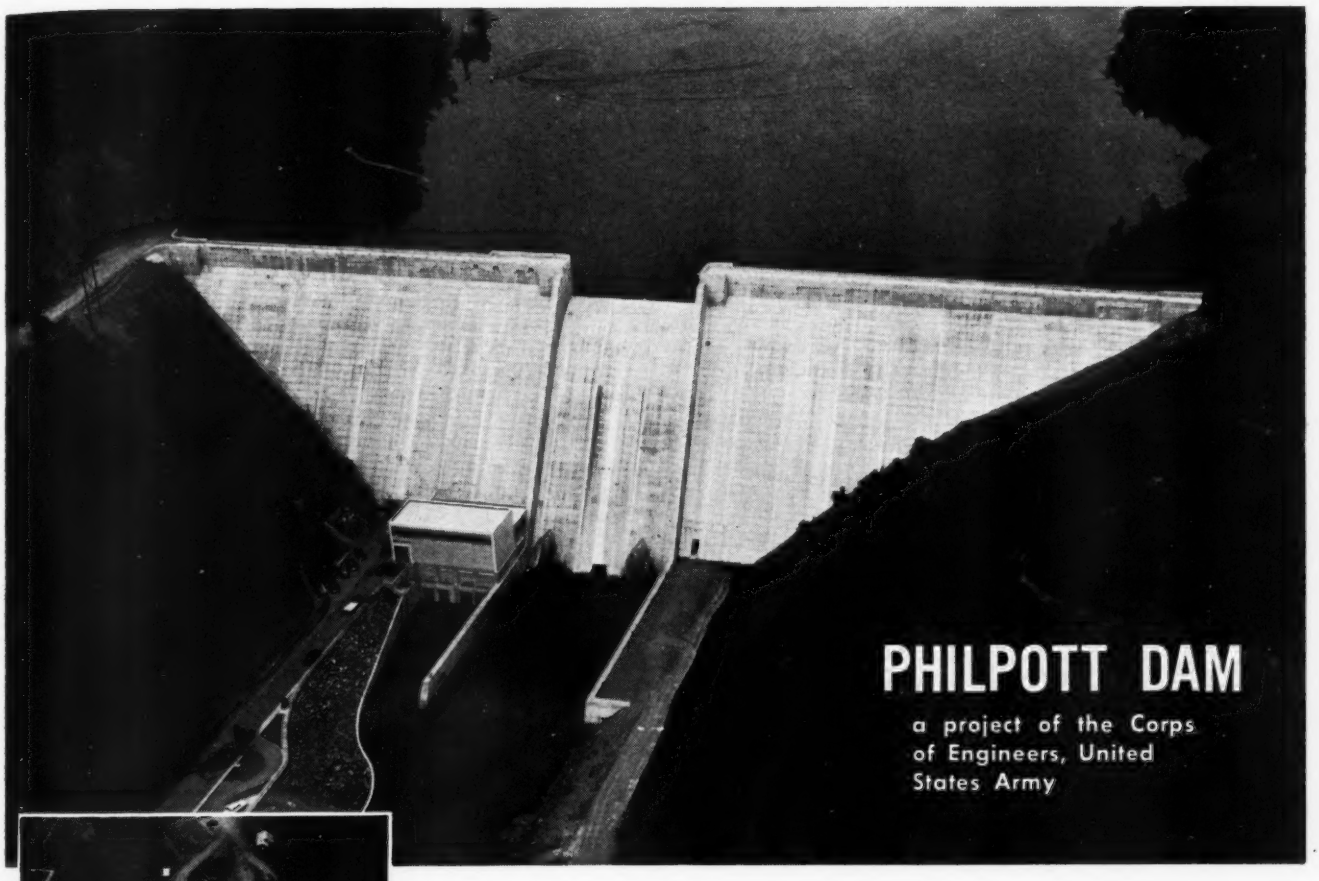
African Railway

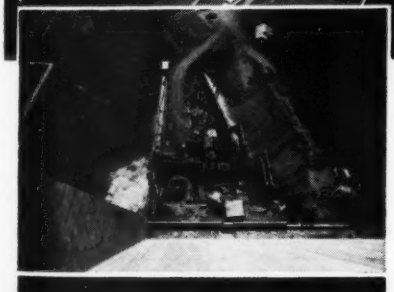
For the 51-mile railroad recently completed by a British construction firm on the Gold Coast of West Africa, more than 2¼ million cubic yards of earth had to be moved and 1000 acres of dense forest cleared.

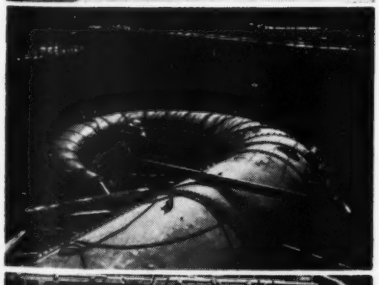
Swamps were carpeted with logs and covered with earth. Of the seven bridges built, the longest was the 240 ft bridge over the Densu River.

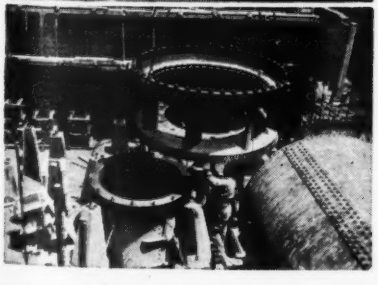
Garbage Burning Plant

The city of Vienna, Austria, with an annual garbage output of 190,000 tons and limited dumping facilities, has under construction a garbage burning plant capable









Another Outstanding Installation of **Leffel Hydraulic Turbines**

Philpott Dam, a new Corps of Engineers, United States Army, project on the Smith River in Henry and Franklin Counties, Virginia, is the site of another outstanding installation of efficient, reliable Leffel turbines. The Philpott project was constructed for flood control, hydroelectric power generation and allied purposes. It is one unit of a comprehensive reservoir system planned for the Roanoke River basin.

Three Leffel turbines were installed in the Philpott power plant. Two are rated at 9400 H.P., 277 R.P.M. at 152 ft. net head and the third at 860 H.P., 720 R.P.M. The view above shows the completed project. The views at left show the powerhouse under construction with the spiral casing for one turbine in place, a close-up of the assembled spiral casing, and the stay ring being lowered into place over the draft tube.

Other Leffel installations are dependably and efficiently producing power from water in all parts of the world. Leffel engineers are waiting to put their 94 years of experience with water power to work for you, whether your project is a completely new installation or expansion or rehabilitation of existing facilities. Write today for literature describing Leffel turbines for all hydraulic power requirements and showing a wide variety of outstanding Leffel installations.

1095-E

FOUNDED IN 1862

THE JAMES LEFFEL & CO.

DEPARTMENT E • SPRINGFIELD, OHIO, U. S. A.

MORE EFFICIENT HYDRAULIC POWER FOR 94 YEARS

of handling 60 percent of the output. When completed, the plant will reduce the distance traveled by garbage trucks annually by about 300,000 miles.

The plant includes three furnaces with a daily combustion capacity of 200 tons. The combustion process is continuous and largely automatic. Fumes escape through a 280 ft chimney that is equipped with a cyclone dust separator to eliminate dust and odor. The steam produced in the waste heat boiler is to be used partly for generation of electric power for the plant's own consumption, and the remainder sold to nearby consumers for heat.

Iron from the slag by-product will be removed by a magnet separator and briquetted in a press for sale to industrial consumers. Sterile slag also will be available as fill for building and road jobs.

The first compost producing plant in Vienna went into operation in 1955 with a capacity of 700,000 cu ft. Future plants of this type also are planned to turn additional garbage into compost.

Exchange Students

Under auspices of the International Association for the Exchange of Students for Technical Experience, American engineering students will receive on-the-job training in foreign industrial firms during their summer vacation period this year. Students from the other 20 member countries will also train in countries other than their own. Last year 20 Americans took advantage of the arrangement while 39 students were received by the U. S.

The Institute of International Education is serving as the central co-ordinating agency for U.S. participation in this year's program. Maynard Boring, manpower consultant for General Electric and president of the American Society for Engineering Education is chairman of the Institute's advisory committee. Other members, chosen to represent industry, professional engineering societies, engineering schools, and student groups are: Professor George Brodschi, University of Louisville; Clarence Davies, ASME; Robert Gates, consultant; Olive S. Gray, U. S. National Student Association; S. B. Ingram, Bell Telephone Laboratories; H. N. Muller, Westinghouse Electric Corp.; P. T. Sowden, consultant; and Professor Arthur Tichenor, Purdue University.

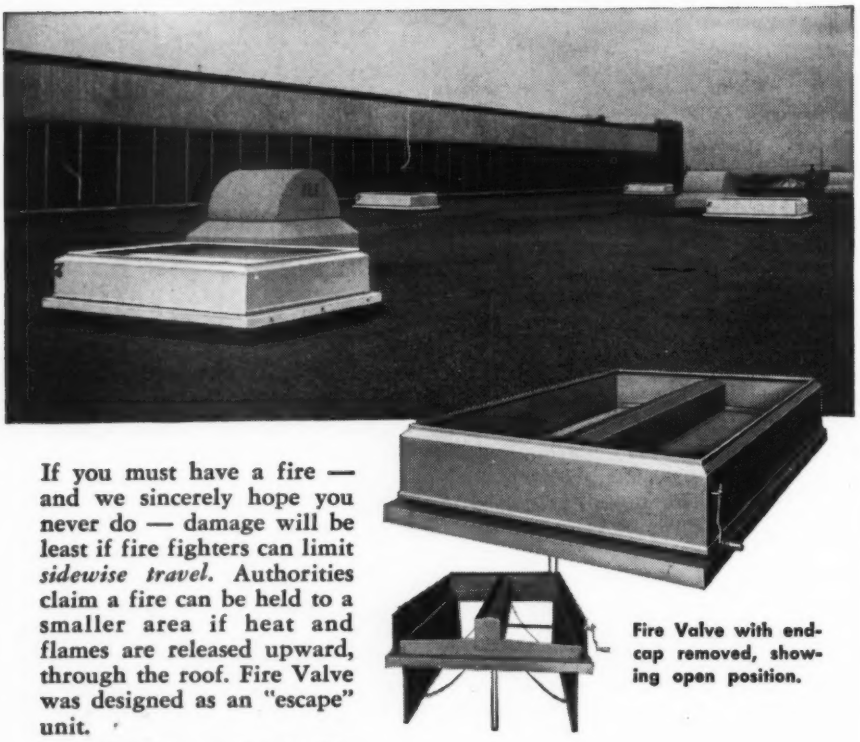
More Roads for France

France is planning the addition of 1250 miles of high speed, wide laned highways between 1957 and 1960. The new roads will connect the cities of Paris and Lille, Metz and Nancy, Paris and Lyons, Lyons and Marseilles, Paris and Chartes, Paris and the Normandy coast, and Strasbourg and Basle. The first main link to be constructed will be between Frejus and Nice, on the Riviera. Other highways will serve as bypasses around Paris and other cities with heavy traffic problems. ▲▲

How to minimize the risk of

FIRE SPREAD

with **Swartwout FIRE VALVE®**



If you must have a fire — and we sincerely hope you never do — damage will be least if fire fighters can limit *sidewise travel.* Authorities claim a fire can be held to a smaller area if heat and flames are released upward, through the roof. Fire Valve was designed as an "escape" unit.

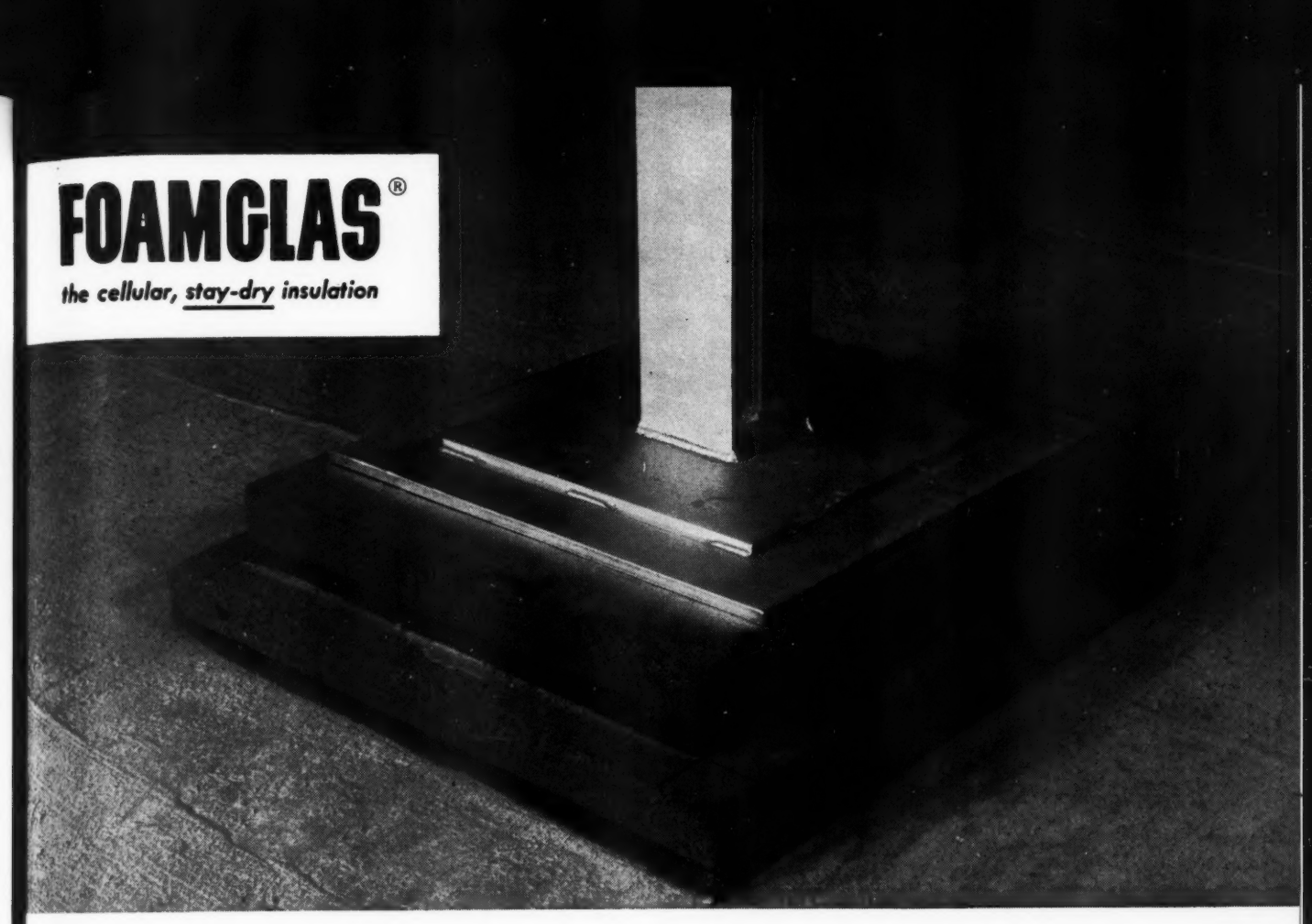
Fire Valve with end-cap removed, showing open position.

Excessive heat melts fusible links at the Fire Valve damper, causing two large dampers to drop open *instantly.* The open valve provides 46 square feet of frec area for unobstructed vertical exhaust flow, protected from effects of wind currents by the side baffles. Smoke rises, instead of hiding the flame source. Fire fighting can be augmented from the roof. The Swartwout Fire Valve is a neat low unit which may be opened manually for extra ventilation in good weather. Learn more about this valuable aid for limiting fire spread — write for Bulletin FV-P.

The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio

Swartwout ROOF VENTILATORS AND VENTILATING LOUVERS

AUTRONIC PROCESS CONTROL EQUIPMENT



President Carl Steimle of Southern Michigan Cold Storage says...

"The weight of our new warehouse actually rests on FOAMGLAS floor insulation"

"FOAMGLAS floor insulation actually supports much of the weight of our new refrigerated warehouse." That's the report from Carl Steimle, president of Southern Michigan Cold Storage Company, Sodus, Michigan. They picked strong, stay-dry FOAMGLAS to insulate not only the floor, but also the roof, ceilings and all walls of the new building, first stage in a $1½ million building program.

This unique all glass insulation has a compressive strength of over 7 tons per square foot. Mr. Steimle says, "That made it possible to prevent thermal 'short circuits' by putting insulation *between* all load bearing columns and other structural members. All columns bear directly on FOAMGLAS without reducing its insulating performance."

FOAMGLAS can't absorb the moisture that cuts efficiency of other insulations. "The result," concludes Mr. Steimle, "is *constant*, precise control of temperatures (from —35 to +35F°), and we don't have the headache of recurring insulation replacement."

These benefits will be *yours* when you insulate your buildings, piping or equipment with FOAMGLAS. Prove it to yourself with six simple tests which you can perform in your own office. Write today for a free sample and complete testing directions.

Pittsburgh Corning Corporation

Dept. R-66, One Gateway Center

Pittsburgh 22, Pennsylvania

In Canada: 57 Bloor St. W., Toronto, Ontario

Two layers of 4" FOAMGLAS insulate the entire floor area. There are no thermal "short circuits" since all load bearing columns rest directly on this remarkably strong insulation (see close-up, above).

PC® Also manufacturers of PC Glass Blocks

New Projects Reported

By Consulting Engineers—

CALIFORNIA

Cline, Zerkle & Agee. Lompoc Municipal Pool, Lompoc, Calif. $123,000. Client, City of Lompoc.

El Dorado Hotel, Sacramento, Calif. $1,250,000. Client, A.C.E. Builders.

Kenneth Brunner, Civil Engineer. Two sewage treatment plants, 0.5 M.G.D. each, west of Fontana, Calif. Trunk sewers and laterals. $450,000. Client, Western Pacific Sanitation Co., Puente.

CONNECTICUT

Office of Jerome F. Mueller, Consulting Engineers. Power system design for roadway lighting, restaurants, garages, toll stations, etc. for Greenwich-Killingly Expressway, Conn. $2,500,000. Client, Wilbur Smith Associates.

Fred S. Dubin Associates. Temple Beth El, Waterbury, Conn. $250,000. Client, architect, Joseph Stein.

St. Mary's Roman Catholic Church, Clinton, Conn. $150,000. Client, architect, Painchaud & Ryder.

New Canaan Center School, New Canaan, Conn. $300,000. Client, architect, Victor Christ-Janer.

FLORIDA

Ballinger-Meserole Co. Distribution center warehouse near Pensacola, Fla. Client, The Lewis Bear Co., Inc.

Thomas E. Blakley Associates. Electrical design of Simmons Bedding Co., Jacksonville, Fla. plant. $1,250,000. Client, Simmons Co.

Gee & Jenson, Inc. Forty-five miles of 24 and 36 in. water supply main including a well field, pumping station, distribution reservoirs, and assorted 8 in. distribution lines. $7,000,000. Client, City of Cocoa, Fla.

E. J. Kelly & Associates, Inc. Citrus processing plant including extraction, concentration, canning, freezing, cold storage and feed mill, Ft. Pierce, Fla. $1,500,000. Client, Treesweet Products Co., Santa Ana, Calif.

GEORGIA

Thomas E. Blakley Associates. Electrical design of Peachtree Baker Office Building, Atlanta, Ga. $2,500,000. Client, Massell Companies.

IDAHO

Hamilton and Voeller. Location of forest access roads, Idaho. $456,000. Client, U. S. Forest Service.

Location and design of forest access secondary highway, Idaho. $200,000. Client, Bannock County, Idaho.

Hamilton and Voeller associated with **Barnard and Burk.** Natural gas distribution system, Pocatello, Idaho. $1,558,000. Client, Pocatello Cooperative Gas Association.

Natural gas distribution system, Montpelier, Idaho. $170,000. Client, Montpelier Cooperative Gas Association.

Natural gas distribution system, Jerome, Idaho. $455,300. Client, Jerome Cooperative Gas Association.

Natural gas distribution system, Rupert, Idaho. $254,600. Client, Rupert Cooperative Gas Association.

ILLINOIS

Thos. J. Higgins Associates, Inc. Addition to plant, 162 x 170 ft one-story brick building, 60 x 100 ft one-story brick building, structural steel frame, steel bar joist roof, precast concrete slabs, steel sash, three 5-ton cranes, one 3-ton crane, and cooling towers

NATIONAL
HYDRO-FILTER
stops dust here
This violently turbulent area of water, bubbles and mist is the "heart" of a revolutionary new concept of dust collection. Our bulletin describes how the National Hydro-Filter uses this principle to assure you a welcome combination of constant efficiency (to the micron range) and complete simplicity of maintenance and operation.
Write for literature today. See what we mean when we say . . .
NATIONAL
If you're tired of Dust Collector maintenance you're ready for Hydro-Filter!
Dust Collector Corp.
606 Machinery Hall Bldg., Chicago 6, Illinois

PYLE-NATIONAL
TURBINES
Economical • Dependable • Safe
For the mechanical drive of pumps, exhaust fans, blowers, stokers, abrasive wheels, agitators, generators and other machinery. Operate with steam, gas or air.
Write for Bulletins No. 4110-A to 4110-F inc., describing this outstanding line of small and medium capacity turbines ranging from ¼ to 120 horsepower. Also Bulletin on turbo-generators rates 500 to 15,000 watts, D.C.
THE PYLE-NATIONAL COMPANY
1337 North Kostner Avenue, Chicago 51, Illinois
SINCE 1891

Anaconda 15 kv aerial cable installed at oil refinery.

New high-voltage cable cracks the ozone barrier

SAMPLES of Type AB insulated cable bent in small circles are placed in ozone chamber for ozone-resistance test.

Butyl insulation in Anaconda Cable exceeds ozone-resistance test requirements by 2400%

Under high electric stress, minute particles of air break down, form corona. This generates ozone which may combine with the rubber hydrocarbon of the insulation. Without superior ozone resistance, the insulation fails.

But now you can get extra protection against ozone—and ozone damage—with Anaconda Type AB butyl-insulated cable. This insulation is compounded for *inherent* ozone resistance along with other desirable properties.

In standard ozone-chamber test, Type AB insulation (after aging) shows no injury after 72 hours in 0.025-0.030% ozone concentration . . . 24 times longer than required by oil base and butyl specifications.

New Engineering Bulletin EB-27 gives full details on performance of Type AB insulation in 15 Industry Specification Tests. See the Man from Anaconda or write: Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y. 56297

SEE THE MAN FROM ANACONDA®

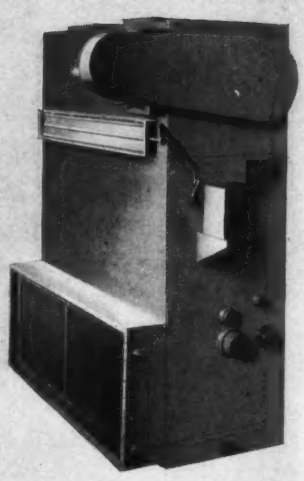
pioneer in BUTYL INSULATION

"Buffalo" units maintain air comfort in our "ATLANTIC WATCH TOWERS"

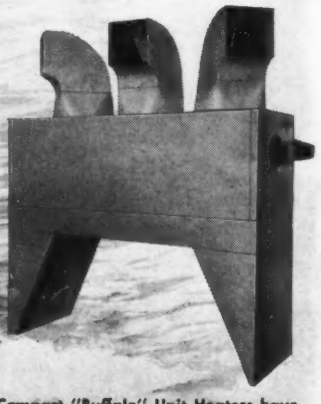
This radar-equipped Tower, standing continuous long-range lookout over the Atlantic, takes a lot of rough weather — yet it's always comfortable inside. 19 dependable "Buffalo" Air Conditioning and Heater Units see to that.

The "Buffalo" Heaters warm the fresh air drawn in from outside for the living quarters; while the "Buffalo" Cabinets maintain accurate temperature control and clean, filtered air in the radar control room.

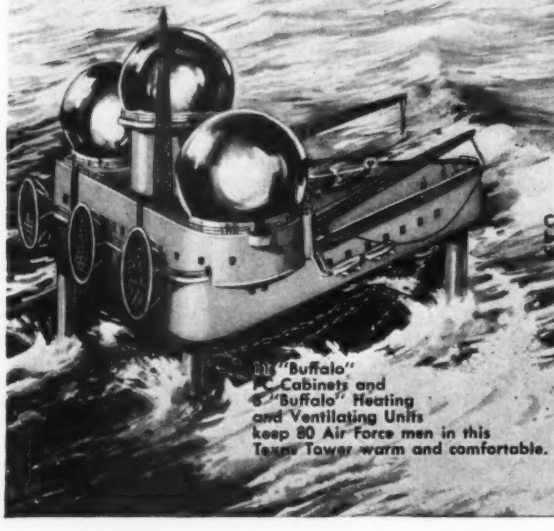
You'll find "Buffalo" Units like these doing important "climate" jobs in every type of plant, store and public building — heating, cooling, ventilating, controlling humidity, filtering or washing air — and doing it with complete reliability. For any air handling or processing job you have, look to "Buffalo". Air has been our business for 79 years.



"Buffalo" PC Cabinets provide any desired combination of air conditioning functions. Write for Bulletin 3703.



Compact "Buffalo" Unit Heaters have built-in fans and swivel outlets. Write for Bulletin 3704.



"Buffalo" PC Cabinets and "Buffalo" Heating and Ventilating Units keep 80 Air Force men in this Texas Tower warm and comfortable.

BUFFALO FORGE COMPANY
BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

for quenching water, tanks, etc. $250,000. Client, Lindberg Steel Treating Co., Melrose Park, Ill.

Fred S. Dubin Associates. Kordite Plastics Plant, Div. Textron, Urbana, Ill., including design of 500 ton process refrigeration system for process cooling. $750,000. Client, architect, Cull, Robinson & Green; builder, Gilbane Construction Co.

INDIANA

Gibbs & Hill, Inc. Design and construction supervision of 105,000 kw extension to Harding Street generation station at Indianapolis, Ind. Part of $57,000,000 power expansion program for Indianapolis area. Client, Indianapolis Power & Light Co.

Frederick B. Morse, P. E. and Hannan, Meek & Cordill. Design, plans and specifications for new power house for Richmond State Hospital. $1,200,000. Client, Atkinson Associates, Inc. for State of Indiana.

KANSAS

Servis, Van Doren & Hazard. Seventeen miles relocation of U. S. Highway 50 near Olathe, Kans. — limited access, four lane. $5,000,000. Client, Kansas Highway Commission.

LOUISIANA

Thomas E. Blakley Associates. Additions and alterations to Southern Bell Telephone and Telegraph Company's Dial and Toll Office Building, Lafayette, La., electrical design. $1,250,000. Client, Armistead & Saggus, Arch.

MASSACHUSETTS

Fred S. Dubin Associates. Temple Mishkan Tefila, Newton, Mass. $1,200,000. Client, architect, Percival-Goodman.

Mile, Hart & Gordank, Inc. Knights of Columbus social and meeting building, Everett, Mass. $50,000. Client, Knights of Columbus.

Clinic, Boston, Mass. $100,000. Client, Medical Associates.

Office of Jerome F. Mueller, Consulting Engineers. Mechanical and electrical design for St. Agnes School and Church, Dalton, Mass. $500,000. Client, Morris W. Mahoney, Architect.

MICHIGAN

H. E. Beyster & Associates, Inc. Juvenile Detention Home with facilities for 250 children. $3,200,000. Client, Wayne County, Mich.

Yamasaki, Leinweber & Associates. 16 classroom elementary school, Wayne, Mich. $400,000. Client, Wayne School System.

Wayne University conference building, Detroit, Mich. $1,000,000. Client, Wayne University.

A.C.I. Office Building, Detroit, Mich. $150,000. Client, American Concrete Institute.

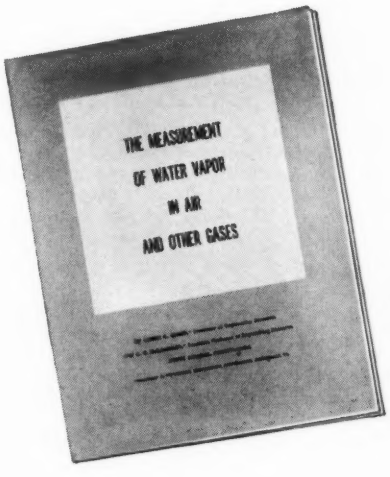
Married students' housing, University of Mich., Ann Arbor, Mich. (300 units).

Lord Kelvin said it in 1883—

"...when you can measure what you are speaking about, and express it in numbers, you know something about it..."

moisture

... is a troublemaker or a benefit, dependent upon your interest and industry. You need to get rid of moisture to keep a process percolating, or add it to promote another. But in most cases, you need to know *when* moisture is present and *how much.*



Moisture in air and gases causes definite phenomena, which suggest methods of measuring amounts of moisture present. These physical facts, and their relationship, have been the subject of extensive research by Elmer R. Queer and E. R. McLaughlin of State College, Pa., consultants to Pittsburgh Lectrodryer Company.

Their findings and recommendations are reported in the new book, The Measurement of Water Vapor in Air and Other Gases—one of a series. You may have a copy.

Lectrodryers* offer a dependable, economical means of removing unwanted moisture from air, gases and organic liquids. Proved in thousands of plants all over the world, they range in size from tiny laboratory models to giant wind tunnel driers. They work at atmospheric pressure up to 6,000 psi. Lectrodryer engineers can call on many years of DRYing experience to help you solve moisture problems. Pittsburgh Lectrodryer Company, 357 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

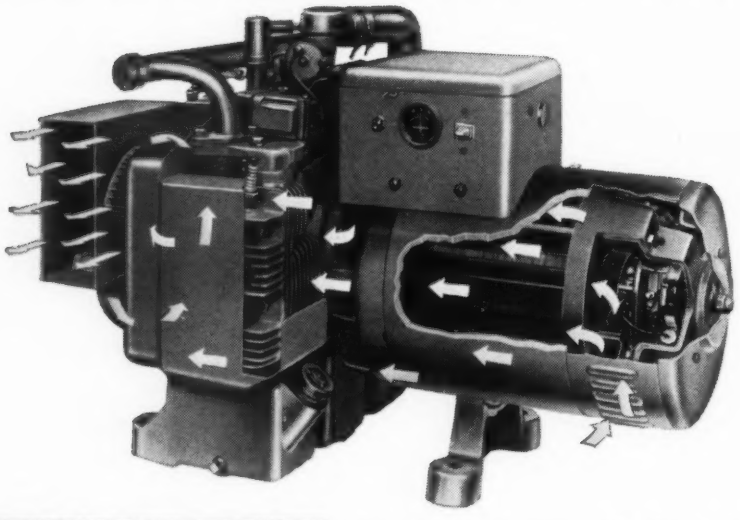
In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
In France: Stein et Roubaix, 24 Rue Erlanger, Paris XVI.
In Belgium: S. A. Belge Stein et Roubaix, 320 Rue du Moulin, Bressoux-Liege.

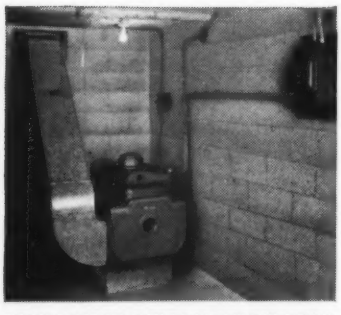
LECTRODRYERS DRY
WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U.S. PAT. OFF.

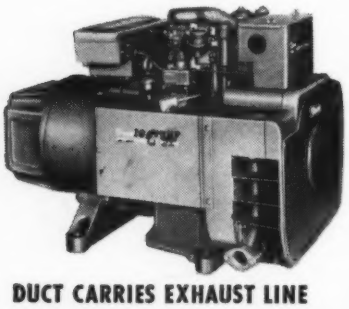
HOW Vacu-Flo AIR-COOLING SIMPLIFIES INSTALLATIONS OF ONAN ELECTRIC PLANTS





VENTILATES INSTALLATION AREA

Vacu-Flo cooling takes air from the room, through the electric plant, and expels it outside through a single duct. Eliminates fumes; keeps room filled with fresh air.



DUCT CARRIES EXHAUST LINE

On the Onan CW series of electric plants (7½ and 10KW), the exhaust pipe is carried through vent duct to the outside making only a single opening necessary.

Heated air expelled outside through single vent. Units can be enclosed or "buried"

Air-cooled Onan Electric Plants can now be installed in small, enclosed compartments; in isolated or underground rooms; or "buried" within a vehicle, far from the outside air. Previously impossible or difficult installations are now easy and practical with Onan Vacu-Flo cooling.

This exclusive system is a factory-equipped item, optional on any Onan air-cooled electric plant. A quiet-running, centrifugal blower in a specially-designed housing PULLS cooling air through the generator and over the engine . . . then EXPELS heated air through a duct to the outside.

The space required in a "buried" installation need be only a little larger than what the unit itself requires. Air-intake and vent openings plus an exhaust line are all that are necessary.

On vehicles such as trailers, display vans, fire and rescue trucks, and concession wagons, Vacu-Flo cooling makes it possible to mount the Onan plant anywhere in the body where space is available. On pleasure and work boats, Vacu-Flo cooling makes below-deck installations of air-cooled electric plants practical . . . cooling efficiently and quickly eliminating fumes from the area.

Onan Electric Plants with Vacu-Flo cooling operate more quietly than blower-cooled models . . . an important added advantage in many installations.

Write for Special Vacu-Flo folder.

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

2848 University Avenue Southeast, Minneapolis 14, Minnesota

$3,000,000. Client, University of Mich.

Junior High School, addition, Troy, Mich. $450,000. Client, Troy Township Public School System.

R. H. Gove. Morren's Plat No. 1, Portage Township, Mich. $17,000. Client, Willis J. Morren, Sr. and Jr.

Fairlane No. 1, Oshtemo Township, Mich. $62,000. Client, TRB Development Corporation.

Shannondale Acres, Portage Township, Mich. $9200. Client, Bernard Mein.

MINNESOTA

Minder Engineering Co., Inc. 1,500,000 gallon reservoir. $100,000. Client, Village of Fridley, Minn.

Sanitary sewer and water mains. $300,000. Client, Village of Fridley, Minn.

Water mains and wells. $400,000. Client, Village of Brooklyn Center, Minn.

Lindsey Engineering Co. Swimming pool and bathhouse. $60,000. Client, City of Caledonia, Minn.

Gausman & Moore, Inc. New boilers and turbine for Fairbault State Hospital, Fairbault, Minn. $240,000. Client, State of Minnesota.

Nielsen and Bruch. Air conditioning of approximately 700 guest rooms for Curtis Hotel, Minneapolis. $660,000. Client, Owner.

High school, 7 classrooms, library, science room, kitchen, shops, home economics department, gym to seat 1000. General, mechanical, and electrical work. Minneapolis, Minn. $800,000. Client, Swanson, Matson and Wegleitner, Architects.

Two school units. Elementary school, 12 classrooms, kindergarten, physical education and lunch room, library, offices. $1,200,000. Client, Thief River Falls, Minn.

High school & vocational school addition. Assembly, lunch room, kitchen, nurses department, beauty culture department, industrial arts department, mechanical drawing dept., metal shop, welding dept., radio and electronics dept., agricultural classroom and shop, auto mechanics shop, building trades shop, offices, and storage spaces. General, mechanical, and electrical work. Client, Swanson, Matson and Wegleitner, Architects.

NEW YORK

Gibbs & Hill, Inc. Plans and specifications and supervision of construction for 10,000 ft of trunk sewer in Westchester County, N. Y. $450,000. Client, Westchester County, N. Y.

Seelye, Stevenson, Value & Knecht. Central air conditioning system for New York International Airport's "Terminal City." $400,000. Client, The Port of New York Authority.

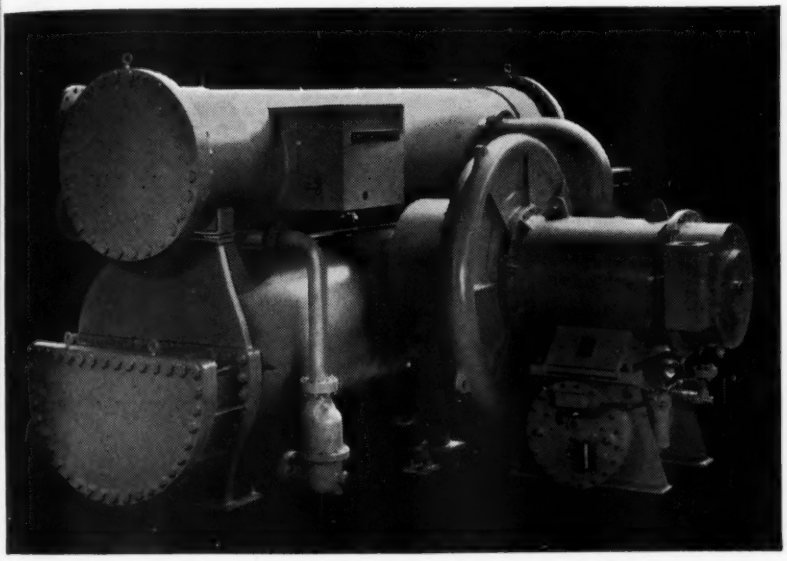
NORTH DAKOTA

K. B. MacKichan & Associates. Water plant. $200,000. Client, City of Rugby, N. D.

Curb and gutter and asphalt cement

Cuts cooling, installation, and maintenance costs!

SINGLE-STAGE TONRAC® INSTALLS ON ONE LEVEL

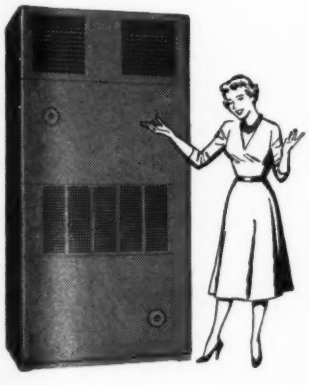


American Blower Tonrac automatically maintains chilled-water temperature, *regardless of load!* Requires no built-up bases.

An advanced-design, hermetic centrifugal refrigerating machine — Tonrac comes complete, ready for installation on *one* level. No built-up bases, flexible couplings, or speed-increasing gears are needed: The single impeller is directly driven by a constant-speed 3600 rpm motor. Saves weight, space, installation costs!

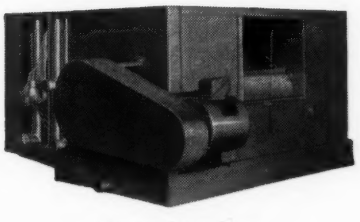
Tonrac cuts operating and maintenance costs, too, for it achieves compression in *one* stage . . . allowing two-bearing construction, and eliminating compression losses and power waste that are common with multi-stage units. This single-stage, hermetic design — with its inherent simplicity and few moving parts — assures quieter operation: makes even the roof an ideal location for Tonrac!

For full facts, call our nearby representative. Or write direct for Bulletin 1426.

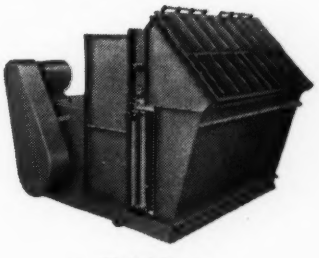


Packaged Air Conditioners for offices, stores, industrial plants, and similar applications. Cools without chilling. 3- thru 20-ton capacities.

American Blower equipment answers all your air conditioning needs



Central-Station Air Conditioners



Multi-Zone Air Conditioners

American Blower offers a complete product line, designed and engineered to meet the exact specifications of your air conditioning requirements. Call on us, today, and pinpoint equipment responsibility for your entire system!

American Blower products serve industry

- Air Conditioning, Heating, Ventilating Equipment
- Mechanical Draft Fans
- Industrial Fans and Blowers
- Centrifugal Compressors
- Gyrol Fluid Drives
- Dust Collectors
- Refrigerating Machines

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American-Standard

AMERICAN 75th ANNIVERSARY YEAR **BLOWER**

Air conditioning equipment for every business

This Niagara Aero After Cooler also cools compressor jacket and intercooler water.

COMPRESSED AIR
• Lower in Cost
• Drier and Cooler

THE NIAGARA *AERO* AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient.

Drier air gives you better operation and lower costs in using all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara *Aero* After Cooler in less than two years.

Niagara *Aero* After Cooler assures all these benefits because it cools compressed air or gas below the temperature of surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air through a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility systems.

Write for Bulletin No. 130

NIAGARA BLOWER COMPANY
Dept. C.O., 405 Lexington Ave.
NEW YORK 17, N. Y.
District Engineers in
Principal Cities of U. S. and Canada

pavement. $150,000. Client, City of Ashley, N. D.

PENNSYLVANIA

Parsons, Brinckerhoff, Hall & Macdonald. Parking survey of central business district including site selection, functional plans, operating procedures, estimates of costs and revenues for proposed facilities. Client, Greater Pottstown Chamber of Commerce, Pa.

The Ballinger Co. Cable-suspension aircraft hanger at Philadelphia International Airport for housing and servicing of two Super-G Constellations at one time. Client, Trans World Airlines.

Ammann and Whitney. Structural engineers for above project.

WASHINGTON

H. E. Bovay, Jr., Consulting Engineers. Renovation of domestic water distribution system. $250,000. Client, Vera Irrigation District No. 15, City of Veradale, Wash.

Plant gas conversion. $200,000. Client, Kaiser Aluminum and Chemical Corp., Trentwood Works, Spokane, Wash.

FOREIGN

Associated Engineers, Inc. Planning consultants for Thorncliffe Park Ltd.—a 392-acre development in the heart of Toronto, Canada, comprising 4000 apartment dwelling units, schools, churches, shopping center, commercial office buildings, light industry, and recreational parks. $100,000,000. Client, F. H. McGraw Co. of Ontario.

Fred S. Dubin Associates. Compania De Hoteles LaRiviera De Cuba, Havana, Cuba, S.A. $6,000,000. Client, architect, Philip C. Johnson.

Ben Franklin Foundation Conference Hall, exhibition halls, offices, library, lounge, Berlin, Germany. $3,500,000. Client, architect, Hugh Stubbins Assoc.

Hotel, preliminary planning, Montego Bay, British West Indies, $3,000,000. Client, The Architects Collaborative, Cambridge, Mass.; Owner, Peter Vischer.

The H. K. Ferguson Co. of Great Britain Ltd. Partial design and complete construction management services for titanium fabrication mill at Waunarlwydd, South Wales. $6,000,000. Client, Imperial Chemical Industries Ltd.

Parsons, Brinckerhoff, Hall & Macdonald. Basic design of ventilation, fire protection, and electrical systems for four-lane Catumbi-Laranjeiras rock tunnel. Client, City of Rio de Janeiro, Brazil, S. A.

PLEASE REMEMBER

To send us information on your New Projects for listing in this column — name or type of project, location, total estimated cost, and name of the client.

ERNST
Boiler Accessories

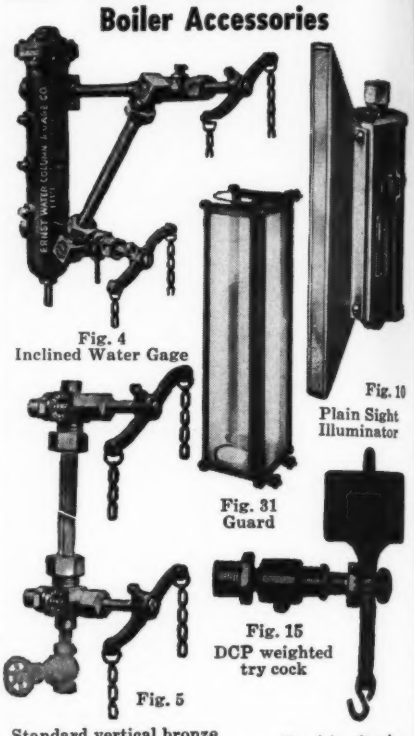
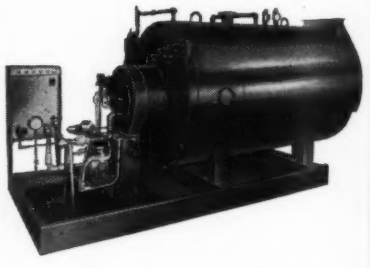


Fig. 4 Inclined Water Gage
Fig. 10 Plain Sight Illuminator
Fig. 31 Guard
Fig. 15 DCP weighted try cock
Fig. 5

Standard vertical bronze water gage, 350 pound

Send for Catalog

ERNST WATER COLUMN & GAGE CO.
Livingston, N. J.



"PACKAGED"
STEAM BOILERS.

Completely Equipped and Tested at factory.

Fully Automatic for Gas or Heavy Oil or Combination Oil and Gas.

75 to 750 Horsepower. High and Low pressure. A.S.M.E. Code and Nat'l Board.

Efficiency and Capacity guaranteed.

Underwriter's Laboratory and Factory Mutual approved.

Detailed Specification Forms, Catalog, and other Engineering Data gladly furnished.

JOHNSTON BROTHERS, INC.
FERRYSBURG, MICHIGAN
Established 1864

Why Sorgel dry-type transformers were selected

for the two largest buildings erected in New York City since the war

SOCONY MOBIL BUILDING, the largest air-conditioned office building in the world.

Architects: Harrison & Abramovitz.
Associate Architect: John B. Peterkin.
Electrical Engineer: Edward E. Ashley.
Electrical Contractors: Fischbach & Moore, Inc.

Higher Voltage Distribution

Higher voltage distribution, with dry-type transformers at load centers, which we have been advocating for 40 years, is now recognized as the most efficient and economical method of interior electrical distribution. It has been adopted for the Socony Mobil Building and the new Coliseum in New York City.

NEW YORK COLISEUM, the largest exhibition building of its kind in the world.

Architects: Leon and Lionel Levy, with Aymar Embury II, Otto Eggers of Eggers & Higgins, and John B. Peterkin, as a consulting and advisory committee.
Engineer: Guy B. Panero.
Electrical Contractors: Jackson-Livingston.

Most Quiet Operation Demanded

The engineers' principal requirement was that the transformers have a low sound level. Regular tests, made in our laboratory, prove that the sound level of SORGEL dry-type transformers is well below the established standards. Because of their unusually quiet operation, SORGEL transformers are particularly adaptable for any indoor installations.

Liberal Design for Full Rated Load

SORGEL dry-type transformers are guaranteed to carry the full load continuously at a safe, low operating temperature. They are so liberally designed that they can safely carry an overload during an emergency.

SORGEL TRANSFORMERS

Tested and approved by Underwriters' Laboratories under the Re-examination Service

SORGEL ELECTRIC CO., 843 West National Ave., Milwaukee 4, Wisconsin

Sales Engineers in Principal Cities

HOW TO GET AROUND TIME and COST FACTORS

in Protecting Pipe Against Corrosion

When you are faced with the problem of protecting piping underground in highly corrosive soils, a high quality coal tar coating such as called for in AWWA Specifications C-203 and C-204 is normally hot applied at a pipe coating mill. However, in many cases, the volume of pipe does not warrant this expense or the coating mill is too far away to justify the time involved.

That's WHEN Engineers Specify TAPECOAT®

. . . the practical alternate hot-applied coal tar coating in handy tape form

Because TAPECOAT provides a coal tar coating equivalent in long-life protection to hot-applied coating at the mill, engineers are specifying this quality alternate material where time and cost factors preclude mill application.

This practical solution assures the protection required without the need for tar kettles, technical know-how and special crews. Field application costs are reduced because TAPECOAT is so easy to apply, using a torch to soften or bleed the pitch and then spirally wrapping it on the vulnerable surface.

TAPECOAT comes in handy rolls of 2″, 3″, 4″, 6″, 18″ and 24″ widths. Since 1941, it has proved its ability to give lasting protection to pipe, pipe joints, couplings, conduit, cable and insulated piping.

Write for illustrated brochure.

The TAPECOAT® *Company*

Originators of Coal Tar Coating in Tape Form

1569 Lyons Street
Evanston, Illinois

Books

TO ORDER BOOKS

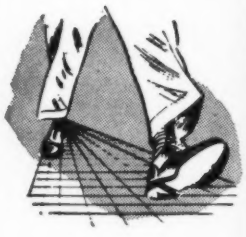
As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes you need. In ordering books, give title, author, and publisher and enclose check. We will also suggest titles of technical books and order for you at regular publishers' prices.

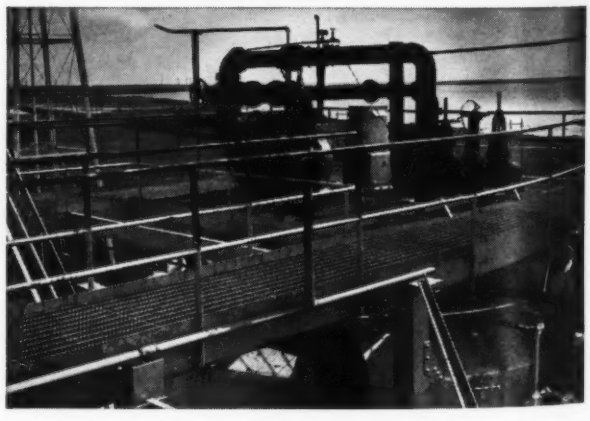
ADVANCED MATHEMATICS FOR ENGINEERS, 3rd Ed., by Harry W. Reddick and Frederic H. Miller; John Wiley & Sons, Inc; 548 pp.; $6.50.

Reviewed by Joseph J. Gershon
DeVry Technical Institute

The book is an excellent text for an engineering student in the third or fourth year in college or a refresher for a practicing engineer. The first two editions have been fairly well accepted by a good many reputable engineering schools. The new one more or less follows the general pattern of the second edition with some revisions and additions to the problems. There also appears ad-

WHERE SURE FOOTEDNESS COUNTS

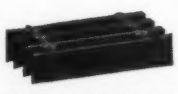




Gary

STEEL GRATING MAKES WALKS SAFER

Sturdy, one-piece construction with tops of all bars flush provides open steel flooring and stairs for safe, easier walking. Gary Grating is furnished in a wide variety of neat appearing designs and sizes—and is tailor-made to fit your needs. For complete description and installation pictures on Gary Welded Grating, Stair Treads and Gary-Irving Decking, ask for Catalog CE-66



FREE SAMPLE
We'll send this handy paper weight if you request it on your company stationery.

Standard Steel Spring Division
ROCKWELL SPRING AND AXLE CO.
4015 East Seventh Avenue • Gary, Indiana

When the pressure is on

As a final step in the manufacture of Powell Valves, every valve is subjected to an *actual line test*—a *positive method* of testing. For special services, valves can be given hydrostatic, air and gas tests so that they will meet various fluid control services.

Thus, when the pressure is on *you*—when you have a production schedule that must be met—that's when you'll be glad you installed Powell Valves.

No matter what your flow control problem may be, Powell has valves designed to solve your problem. And you can *depend* on long, trouble-free service. Through careful quality control, *every* Powell Valve has PERFORMANCE VERIFIED.

Because of Powell's painstaking quality control, plant shutdown through valve failure is greatly reduced. Records from refineries, power and industrial plants the world over prove it.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our *complete quality line* which has *Performance Verified.*

The Wm. Powell Company
Cincinnati 22, Ohio

. . . 110th YEAR

PERFORMANCE
PV
VERIFIED

Bronze, Iron, Steel and Corrosion-Resistant Valves

FIG. 3061-WE—300-Pound Steel Swing Check Valve

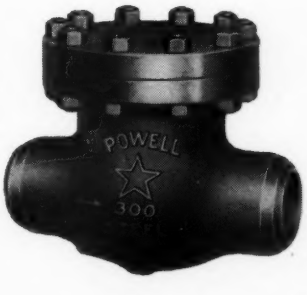


FIG. 19003—900-Pound Steel Pressure Seal Gate Valve

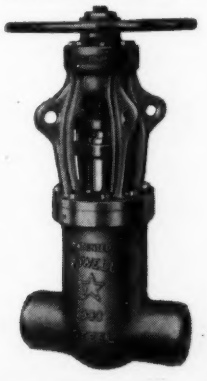
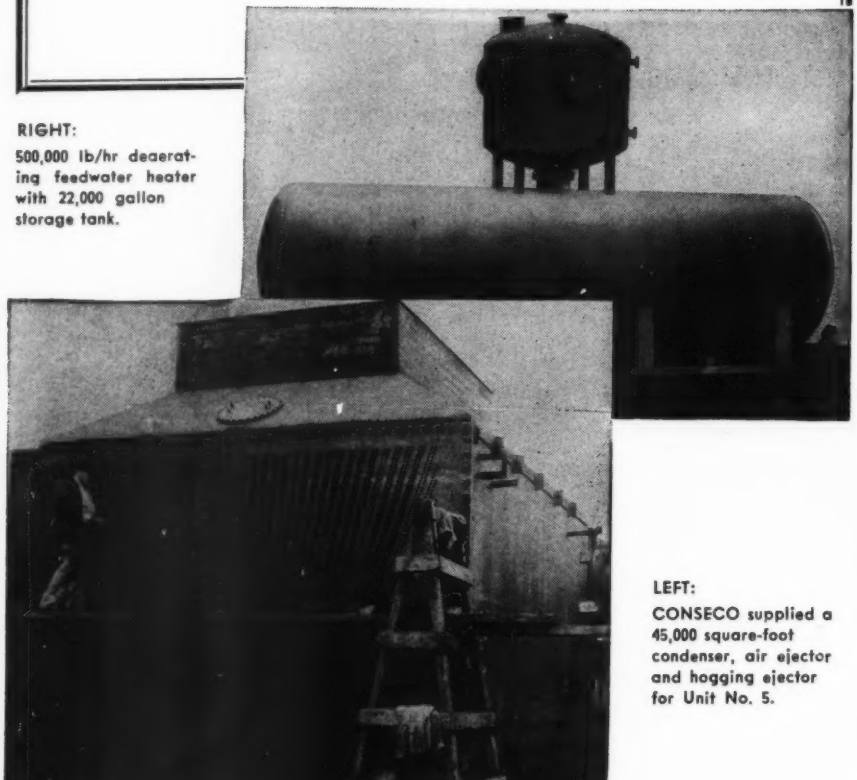


FIG. 1314-A—1500-Pound Integral Bonnet Steel "Y" Valve

POWELL VALVES

SATISFIED PUERTO RICO SENDS ANOTHER ORDER FOR CONSECO



RIGHT:
500,000 lb/hr deaerating feedwater heater with 22,000 gallon storage tank.

LEFT:
CONSECO supplied a 45,000 square-foot condenser, air ejector and hogging ejector for Unit No. 5.

FOR THE SAN JUAN STEAM ELECTRIC STATION

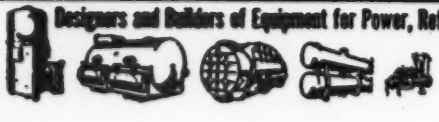
The San Juan Steam Electric Station of the Puerto Rico Water Resources Authority has been so satisfied with Conseco condensing and feed water heating equipment already installed and operating with Units 1, 2, 3, and 4, they ordered additional Conseco equipment, shown above, for Unit 5. The heating section on top of the 36½ ft. storage tank is 9 ft. in diameter, 10 ft. high, A.S.M.E. Code. This is the largest heating unit in the plant, part of the feed-water heating system for the 44,000 KW turbo generator system.

Send for Bulletins on Conseco Condensers and other Conseco Equipment.

Call on CONSECO for emergency retubing, repairs and maintenance of any tubular equipment, any make, any hour, any day (including Sundays, holidays), anywhere on the continent. Phone Maintenance Department.

CONDENSER SERVICE & ENGINEERING CO., INC. CONSECO

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries



163 Observer Avenue
HOBOKEN, N. J.

ditional material with consideration given to the Laplace transforms.

The text initially presents an excellent chapter on ordinary differential equations with explanations that are very clear and easy to understand. The applications are numerous and excellent at this point. The following chapters on hyperbolic functions and elliptic integrals have a number of very fine problems.

The book continues with the infinite series, then the Fourier series. This offered an excellent opportunity for practical applications particularly those concerning electrical engineering, but the author didn't take full advantage of the situation.

The chapters on partial differential equations and vector analysis are good. Both give practical applications with problems.

The remainder of the book concerns probability, functions of a complex variable, and operational calculus.

My preference would have been to expand the last two chapters in particular, with considerably more emphasis on Laplace transforms.

The book on the whole is good and has many excellent applications. The approach used by devoting the earlier chapters to differential equations and thereby familiarizing the student with the subject, then reinforcing his understanding as progress is made through the book, is extremely desirable.

A math text of this type seems to offer the most difficulty to the writer in allocating sufficient material so that the student has a proper basic understanding of each topic before progressing to the next. On the whole, this has been accomplished.

ALSO AVAILABLE

MANUAL OF TILT UP CONSTRUCTION, 4th Ed., by F. Thomas Collins; 101 pp, paper bound; $12.50.

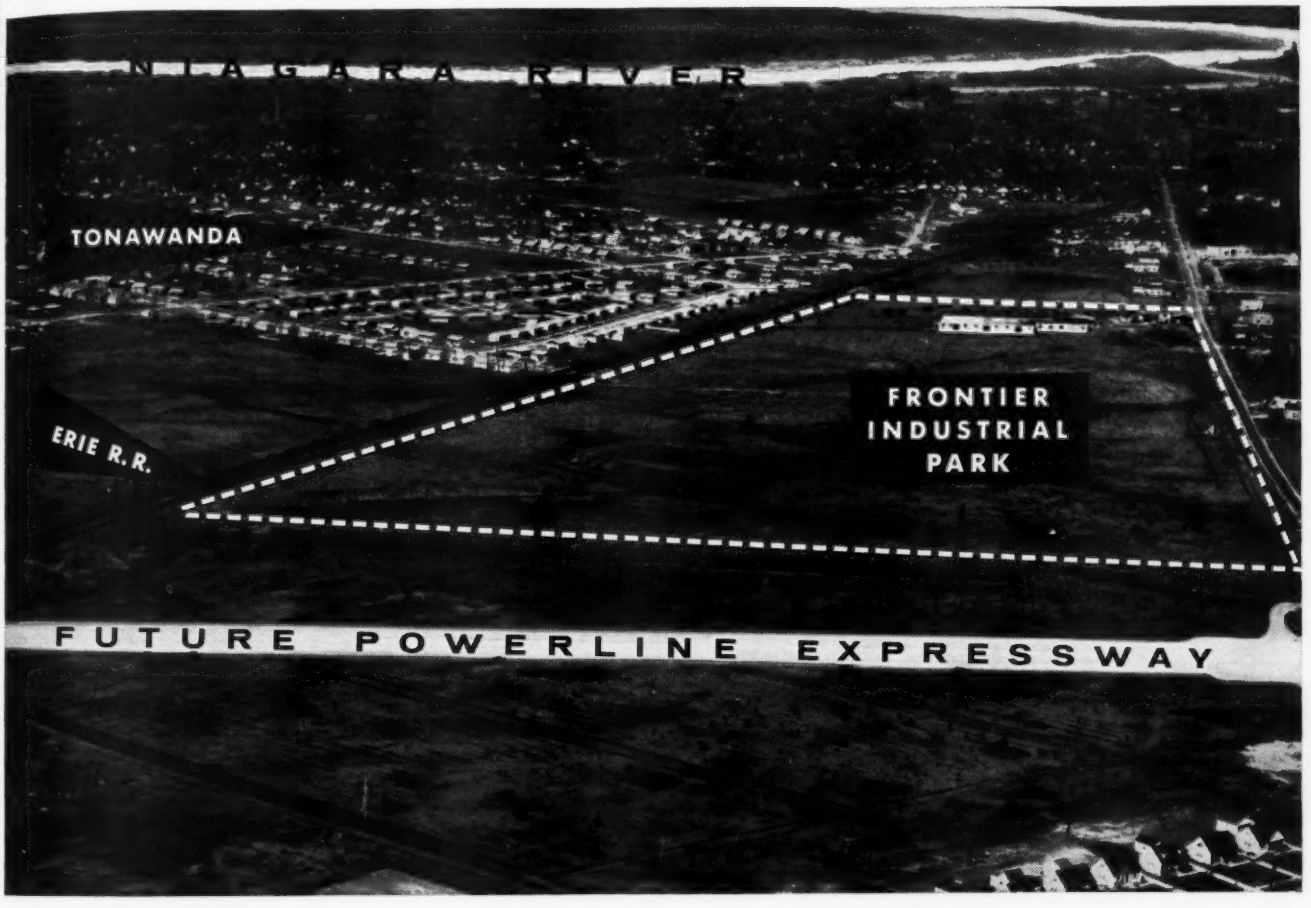
Basic material of the third edition has been included in the fourth edition, with much new material in the chapter on erection and a new approach to the problem of prestressing tilt up wall panels. It begins with a brief review of the history of this type of construction and goes on to give the advantages and disadvantages of flat cast and thin shell construction. The present patent situation is discussed also. It then describes painting of precast concrete, bond breaking, field layout, panel fabrication, and other facets of this type of construction.

•

1955 BOOK OF ASTM STANDARDS; American Society for Testing Materials; $84.00 (in seven sections).

This is actually seven separate books, each available alone. Titles are: FERROUS METALS, 1834 pp.,

YOUR NEW PLANT WILL GROW IN THE ERIE AREA



CHOICE INDUSTRIAL PARK—20 MINUTES FROM DOWNTOWN BUFFALO

FRONTIER Industrial Park, located near Buffalo, second largest city in New York State, now offers level sites for light manufacturing, assembly or service plants.

Check these key advantages:
Seven of the eight largest markets in the United States are within 500 miles shipping distance.

Low-cost power. Coal, oil and gas available from nearby producing points. Abundant supply of water.

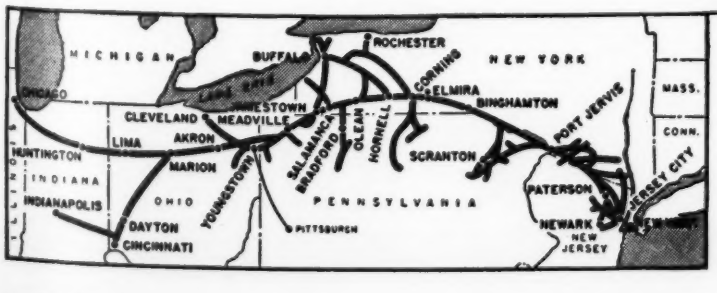
Located in transportation center. Adjacent to the Powerline Expressway, to connect the New York Thruway with other express highways. Buffalo Harbor facilities are unexcelled. All sites are served by the dependable Erie Railroad with connections to New York and Chicago.

Large supply of diversified labor for all needs. Clerical and engineering talent available. Good living conditions including adequate housing are available.

For full information on Frontier Industrial Park and other sites in the Erie Area, mail the coupon below.

Erie Railroad

SERVING THE HEART OF INDUSTRIAL AMERICA



D. M. Lynn, Assistant Vice President
Industrial Development
Room 524-J, Erie Railroad
Midland Building, Cleveland 15, Ohio

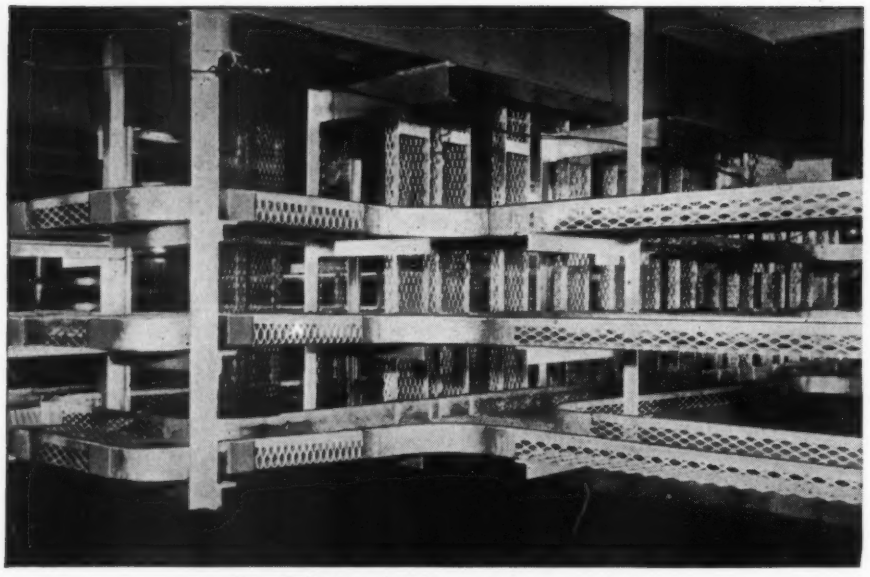
Dear Sir: Please furnish us, in strict confidence, additional information on the above and other plant sites in the Erie Area.

Name _____

Title _____ *Company* _____

Address _____

City _____ *Zone* _____ *State* _____



Cope Cable Trough at Kansas City Power & Light Company's Hawthorn Station.

Kansas City Power & Light Adopts Cope Cable Trough

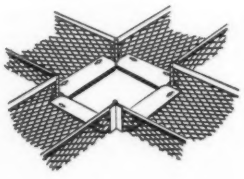
Kansas City Power & Light Company engineers installed versatile Cope Expanded Metal Cable Trough for cable supports in the modern Hawthorn Station. Forward looking engineers in utilities and industry everywhere are building modern distribution systems with Cope Cable Trough.

When you specify an Expanded Metal Cable Trough System you **save materials.** Cope Trough and Rakit Supports provide only the material you need and give you the **lowest installed cost of any cable supporting system.**

Engineers everywhere are specifying Cope Expanded Metal Cable Trough because it:

Saves Materials • Saves Space • Simplifies Maintenance and Inspection
Permits Higher Cable Current Ratings Improves Flexibility

New Cope 70,000 Series features exclusive Pin-Type Coupler that greatly reduces installation time.



C-605

Our engineers are ready to work with you. Write us today for full details on new 70,000 Series.

T. J. COPE, INC.
COLLEGEVILLE 6, PENNSYLVANIA

Cope

TEE

DROP-OUT

CABLE SUPPORTING RISER ELBOW

TROUGH WITH BARRIER STRIPS AND COVER

$13.50; NON-FERROUS METALS, 1516 pp., $11.00; CEMENT, CONCRETE, CERAMICS, THERMAL INSULATION, ROAD MATERIALS, WATERPROOFING AND SOILS, 2062 pp., $13.50; PAINT, NAVAL STORES, WOOD CELLULOSE, WAX POLISHES, SANDWICH BUILDING CONSTRUCTIONS, 1416 pp., $11.00; FUELS, PETROLEUM, AROMATIC HYDROCARBONS, AND ENGINE ANTIFREEZES, 1496 pp., $11.00; ELECTRICAL INSULATION, ELECTRONIC MATERIALS, PLASTICS AND RUBBER, 1776 pp., $13.00; TEXTILES, SOAP, WATER, PAPER, ADHESIVES, SHIPPING CONTAINERS, 1692 pp., $11.00.

•

BIBLIOGRAPHY OF PLANNING, prepared by the Northern California Committee on Land Planning & Civil Engineering of the California Council of Civil Engineers and Land Surveyors; Unbound; Free of charge.

This is broken down into 11 sections: Basic Planning Theory; Planning on the Local Level, Planning Commissions, etc.; Subdivision Design; Subdivisions, General; Urban Renewal; Miscellaneous; Zoning; Traffic and Parking; Shopping Centers; Recreation Facilities; and Industrial Development. Each section lists worthwhile books on the section subject with a description of contents.

FILMS

"SUCCESS STORY," Allis-Chalmers Mfg. Co., 35 mm, sound and color, 15 minutes.

Three major problems and how they were solved in designing the Pneu-Draulic operator for circuit breakers are portrayed in this film. It includes simplified diagrams of the hydraulic circuit showing the nine essential elements in the circuit system.

•

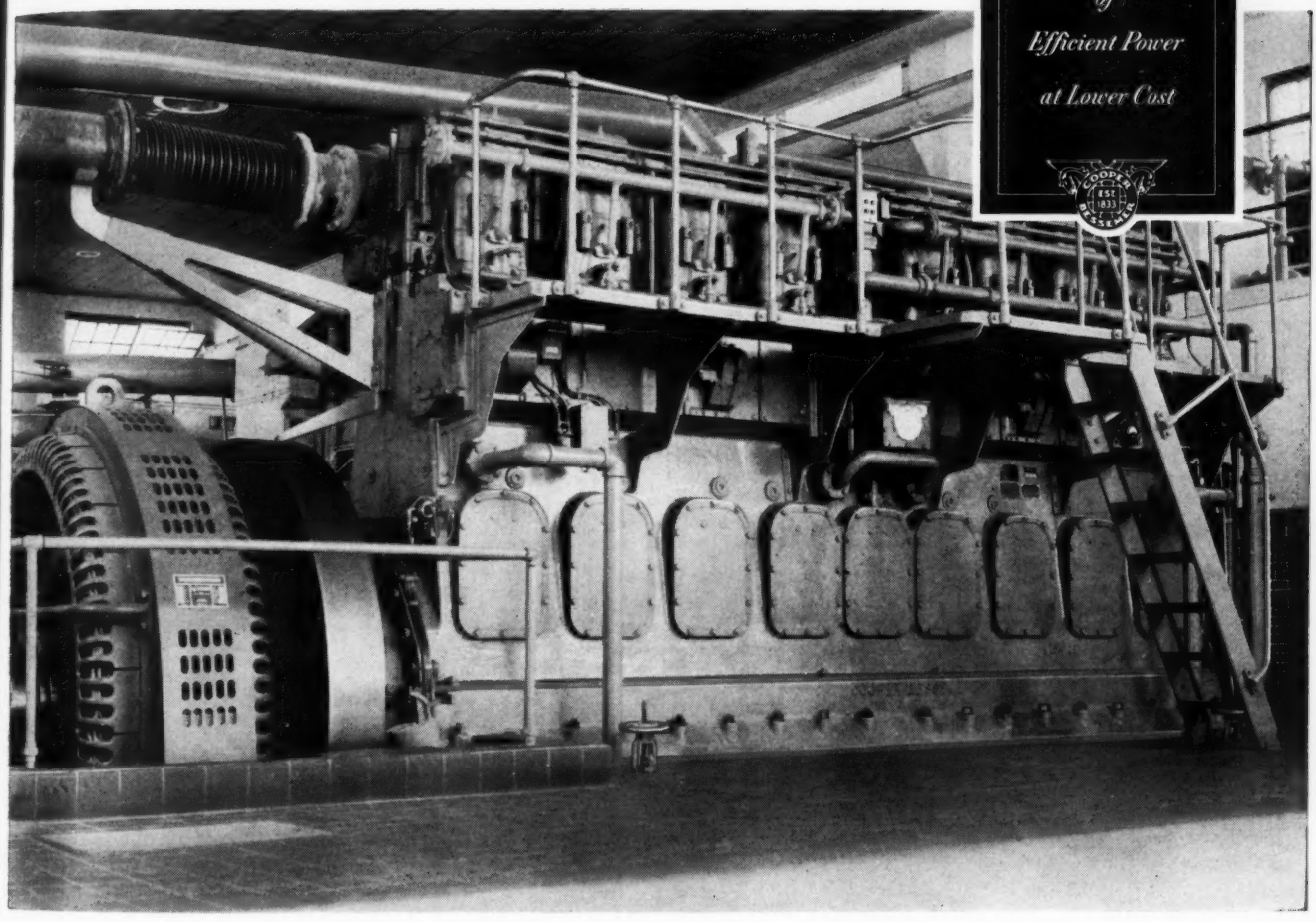
"THE OPERATION AND APPLICATION OF TURBO-DRYERS," Wyssmont Company, Inc., 16 mm, sound and color, 12 minutes.

This film explains drying in general with emphasis on design, operation, and uses of vertical Turbo-Dryers in the food, pigment, coal, fertilizer, chemical process, and related industries.

FOR SALE

Another Example of Efficient Power at Lower Cost

• Here's the 8-cylinder Cooper-Bessemer LS engine, rated 900 hp at 300 rpm, in operation at the Robstown, Texas Light Plant.



Here's the COOPER-BESSEMER PERFORMANCE STORY at Robstown, Texas

- ***Never Re-Rung During 36,000 Operating Hours***
- ***12,000 Hp. Hours Per Gallon of Lube Oil***
- ***In Operation 6,700 Hours on One Set of Spark Plugs***

• The performance of this husky, 8-cylinder Cooper-Bessemer LS engine at the Robstown, Texas Light Plant is mighty good, but really not unusual for Cooper-Bessemers. It's just additional proof of their efficient, lower cost operation.

Remember, Cooper-Bessemer Diesels, gas-diesels and gas-engines are built for all types of heavy-duty stationary or mobile service. Wherever you find Cooper-Bessemers, you can be sure of smooth, economical, trouble-free power.

Find out from the nearest Cooper-Bessemer office how you can meet power needs in the 200-5000 hp range, at the lowest possible cost.

MOUNT VERNON, OHIO

COOPER-BESSEMER

GROVE CITY, PENNA.

New York City • Seattle, Wash. • Bradford, Pa. • Chicago, Ill. Houston, Dallas, Greggton, Pampa and Odessa, Texas Washington, D. C. • Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. • Cooper-Bessemer of Canada Ltd., Edmonton, Alberta—Halifax, Nova Scotia.

DIESELS • GAS ENGINES • GAS-DIESELS • ENGINE-DRIVEN AND MOTOR-DRIVEN COMPRESSORS

consulting engineers' calendar

Date	Sponsor	Event	Location
June 5-8	Materials Handling Institute	Exposition	Cleveland Public Auditorium Cleveland, Ohio
June 6	American Institute of Consulting Engineers	Monthly Meeting	Engineers' Club New York, N.Y.
June 7-9	Michigan Society of Professional Engineers	Annual Convention	Detroit Leland Hotel Detroit, Mich.
June 11-15	Society of the Plastics Industry, Inc.	7th National Plastics Exposition and Conference	N. Y. C. Coliseum New York, N.Y.
June 17-22	American Society for Testing Materials	59th Annual Meeting and Apparatus Exhibit	Chalfonte-Haddon Hall Atlantic City, N.J.
June 17-23	World Power Conference	5th Plenary Meeting	Vienna, Austria
June 18-20	American Society of Heating and Air-Conditioning Engineers	Semi-Annual Meeting	Shoreham Hotel Washington, D.C.
June 27-July 6	American Standards Association	International Electrotechnical Commission Meeting	Munich, Germany
July 6-8	National Federation of Associations of Consulting Engineers	Meeting to Ratify Constitution and By-laws	Mayo Hotel Tulsa, Okla.
Sept. 5	American Institute of Consulting Engineers	Monthly Meeting	Engineers' Club New York, N.Y.
Sept. 9-12	American Institute of Chemical Engineers	Meeting	Wm. Penn Hotel Pittsburgh, Pa.
Sept. 16-22	American Society for Testing Materials	2nd Pacific Area National Meeting and Apparatus Exhibit	Hotel Statler Los Angeles, Calif.
Sept. 17-21	Instrument Society of America	11th Annual Instrument-Automation Conference and Exhibit	N. Y. C. Coliseum New York, N.Y.
Sept. 24-28	Atomic Industrial Forum, Inc.	2nd Annual Trade Fair of the Atomic Industry & Meeting	Morrison Hotel Chicago, Ill.

PROFESSIONAL LISTINGS

MICHAEL BAKER, JR., INC.
Consulting Engineers
Civil Engineers, Planners, Surveyors; Airports, Highways, Water & Sewerage Design; Aerial Topographic Maps; Dams; Irrigation; Reports; All types surveys.
Home Office: Rochester, Pa.; Branch Offices: Jackson, Miss., Harrisburg, Pa.

Capitol Engineering Corporation
Engineers — Construction — Management
Design and Surveys — Roads and Streets
Sewage Systems — Water Works
Planning — Airports
Bridges — Turnpikes — Dams
EXECUTIVE OFFICES
DILLSBURG, PENNSYLVANIA
Washington, D. C. — Pittsburgh, Pa.
Dallas, Texas — Paris, France

DE LEUW, CATHER & COMPANY
CONSULTING ENGINEERS
Transportation, Public Transit and Traffic Problems
Industrial Plants — Grade Separations
Railroads — Expressways
Subways — Tunnels
Power Plants — Municipal Works
150 N. Wacker Drive, Chicago 6, Ill. — 79 McAllister Street, San Francisco 2, Cal.

SEELYE STEVENSON VALUE & KNECHT
CONSULTING ENGINEERS
Richard E. Dougherty, Consultant
Manufacturing Plants
Heavy Engineering
Structural Mechanical Electrical
101 Park Ave. — New York 17, N. Y.

PETER F. LOFTUS CORPORATION
PFLC ESTABLISHED 1923
Design and Consulting Engineers
Electrical • Mechanical • Structural
Civil • Thermodynamic
• Architectural
First National Bank Building
Pittsburgh 22, Pennsylvania

Experience Counts: Dependable Aerial Photos and Topographic Maps for Engineering Planning and Development—Anywhere in the World!
AERO SERVICE CORPORATION
Philadelphia 20, Pa.
Oldest Flying Corporation in the World • Founded 1919

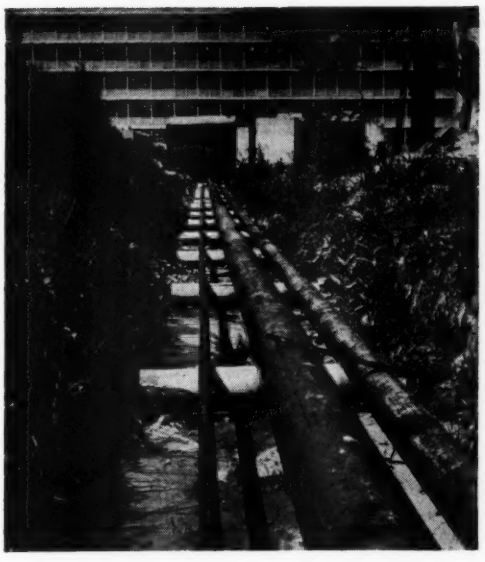
STEVEN ANTONOFF & ASSOCIATES
Engineers—Designers—Consultants
Planning — Bridges
Design — Expressways
Construction — Foundations
Supervision — Municipal Work
Reports — Industrial Plants
806 Park Avenue Building
Detroit 26, Michigan

Abrams Aerial Survey Corporation
Photogrammetric Engineers
PLAN & TOPO MAPS AND MOSAICS FROM AERIAL PHOTOGRAPHY
For Government and Industry
IVanhoe 4-9441 — Lansing, Michigan

HELP WANTED, MALE

ENGINEERS — DRAFTSMEN
If you contemplate moving to Southern California please send us your complete experience and education record.
AUSTIN, FIELD & FRY, A.I.A.
2311 West 3rd St., Los Angeles 57, Calif.

General Contractor: Cauldwell Wingate Co.
Heating & Ventilating Contractors: Raisler Corp.
Architects: Kelly & Gruzen
Consulting Engineers: Jaros, Baum & Bolles



845 feet of steam, condensate and return lines run from college power plant to science building (background). Note spot-welded rods prevent pipes from shifting on supports while pipes are being laid.

Another university approves GILSULATE® for hot underground pipe insulation

Albert Einstein College of Medicine in New York City, the newest of American medical colleges, chose GILSULATE to insulate and protect 845 feet of pipe running from its power plant to its basic science building.

Covered by 138 tons of GILSULATE—with only six men doing the job—are a 10-inch 185-pound steam supply line; 2-inch high pressure return; and a 6-inch condensate line. Pipes were surrounded with an 8-inch envelope of GILSULATE, except under roads and driveways where thickness was increased to 11 inches.

GILSULATE was approved because no other insulation for hot underground pipes could match it in corrosion protection and low cost of installation. It will pay you to investigate this revolutionary material for your next piping job. Fill in the coupon below for more details.

FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour and tamp...pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS:** no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING:** for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE:**
   Type A for 220°-300°F. temp. range
   Type B for 300°-385°F. temp. range
   Type C for 385°-520°F. temp. range

Inexpensive plywood forms were put up to confine the GILSULATE to the area required and cut down on tonnage needed. Men in background are in front of one of the four access chambers.

138 tons of GILSULATE were poured and tamped around the pipes by six men in good time—which included a two-mile truck haul from a railroad siding to the job site. Type B GILSULATE was used—the three protective zones were formed in eight hours.

THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

GILSULATE®

AMERICAN GILSONITE COMPANY, SALT LAKE CITY 1, UTAH
Affiliate of Barber Oil Corp. & Standard Oil Co. of California

American Gilsonite Co.
134-M West Broadway, Salt Lake City 1, Utah — or — 1145 East Jersey St., Elizabeth, N. J.

Send me more information on GILSULATE Insulation

NAME.....

TITLE.....

COMPANY.....

ADDRESS.....

CE

ADVERTISERS' INDEX

Adams Company, Inc., R. P. 72
Adsco Industries, Inc. 68
Aget Manufacturing Company 78
Air Preheater Corporation, The 56
American Blower Corporation 95
American Gilsonite Company 105
Anaconda Wire & Cable Company 91
Armstrong Machine Works 81
Baltimore & Ohio Railroad 64
Bayley Blower Company 25
Borden Metal Products Company 29
Buffalo Forge Company 92
Canton Stoker Corporation 106
Combustion Engineering, Inc. 4
Condenser Service & Engineering Company, Inc. 100
Cooper-Bessemer Corporation 103
Cope, Inc., T. J. 102
Dearborn Chemical Company 83
DeBothezat Fans Div., American Machine & Metals, Inc. 85
De Laval Separator Company, The 17
Erie Railroad Company 101
Ernst Water Column & Gage Company . 96
Fairbanks, Morse & Company 9
Globe Company, The; Grip-Strut Div. .. 82
Golden-Anderson Valve Specialty Company 80
Graver Water Conditioning Company .. 65
Gustin-Bacon Manufacturing Company . 27
Hevi-Duty Electric Company 14
I-T-E Circuit Breaker Company, Switchgear Div. .....Fourth Cover
Jeffrey Manufacturing Company 51
Johnston Brothers, Inc. 96
Josam Manufacturing Company 78
Kawneer Company 71
Layne & Bowler Pump Company 32
Leffel & Company, The James 87
Mahon Company, The R. C. 15
Marietta Concrete Corporation, The ... 84
Marley Company, The 61
Master Builders Company, The .....Third Cover
National Coal Association 108
National Dust Collector Corporation .. 90
Nesbitt, Inc., John J. 13
Newport News Shipbuilding & Dry Dock Company 12
Niagara Blower Company 96
Nickel Plate Road 106
Northern Blower Company, The 31
Ohio Injector Company, The .Second Cover
Onan & Sons, Inc., D. W. 94
Patterson-Kelley Company, Inc., The .. 63
Penn Ventilator Company 70
Pennsylvania Crusher Div. 3
Philadelphia Gear Works, Inc. 80
Pittsburgh Corning Corporation 89
Pittsburgh Lectrodryer Corporation 93
Potts Company, Horace T., Stainless Steel Fittings Div. 79
Powell Company, The William 99
Prat-Daniel Corporation, Power Div. .. 86
Pyle-National Company, The 90
Ranney Method Water Supplies, Inc. .. 74
Reliance Electric & Engineering Company 7
Reliance Gauge Column Company, The 16
Robertson Company, H. H. 107
Servicised Products Corporation 30
Sorgel Electric Company 97
Stainless Steel Fittings Div., Horace T. Potts Company 79
Standard Steel Spring Div., Rockwell Spring & Axle Company ... 98
Stillwater Clay Products Company, The 18
Stran-Steel Corporation 66
Superior Combustion Industries, Inc. 77
Swartwout Company, The; Ventilator Div. 88
Swenson Evaporator Company, Div. of Whiting Corp. 11
Tapecoat Company, The 98
Thermix Corporation, The 86
Todd Shipyards Corporation, Products Div. 84
Tube Turns, Inc. 75-76
United States Steel Corporation, Structural Steels Div. 22-23
Virginia Gear & Machine Corporation . 80
Weighing and Control Components, Inc. 62
Westinghouse Electric Corporation ... 21
White Diesel Engine Div. 19
Whiting Corporation, Swenson Evaporator Co. Div. 11
Whitlock Manufacturing Company 73
Worthington Corporation 69
Yarnall-Waring Company 33

HANDLING BULK MATERIALS?

take it up a Flo-Tube,

the spiral conveyor of dependable service. Used on incline or horizontally.

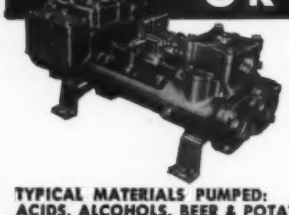
DRIVE

ACCESS PORTS

EXPOSED END IN BIN OR PILE

Mechanically handles materials from grain size to lump . . . sand, rice, seed, pellets, flakes, steel chips, wood waste, coal, etc.

STEEL TUBE OR CAST IRON TROUGH



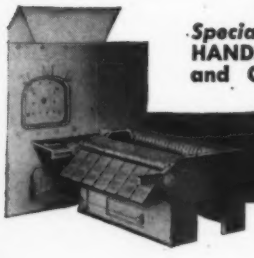
OR LIQUIDS?

WAGENER PUMPS

SIMPLEX DUPLEX

STEAM or POWER models for any need

TYPICAL MATERIALS PUMPED:
ACIDS, ALCOHOLS, BEER & POTATO MASH, DYES, GLUE, OIL (any kind), ASPHALT, BRINE, MILK, MOLASSES, SOAP, SEWAGE, WATER, TAR, GROUT



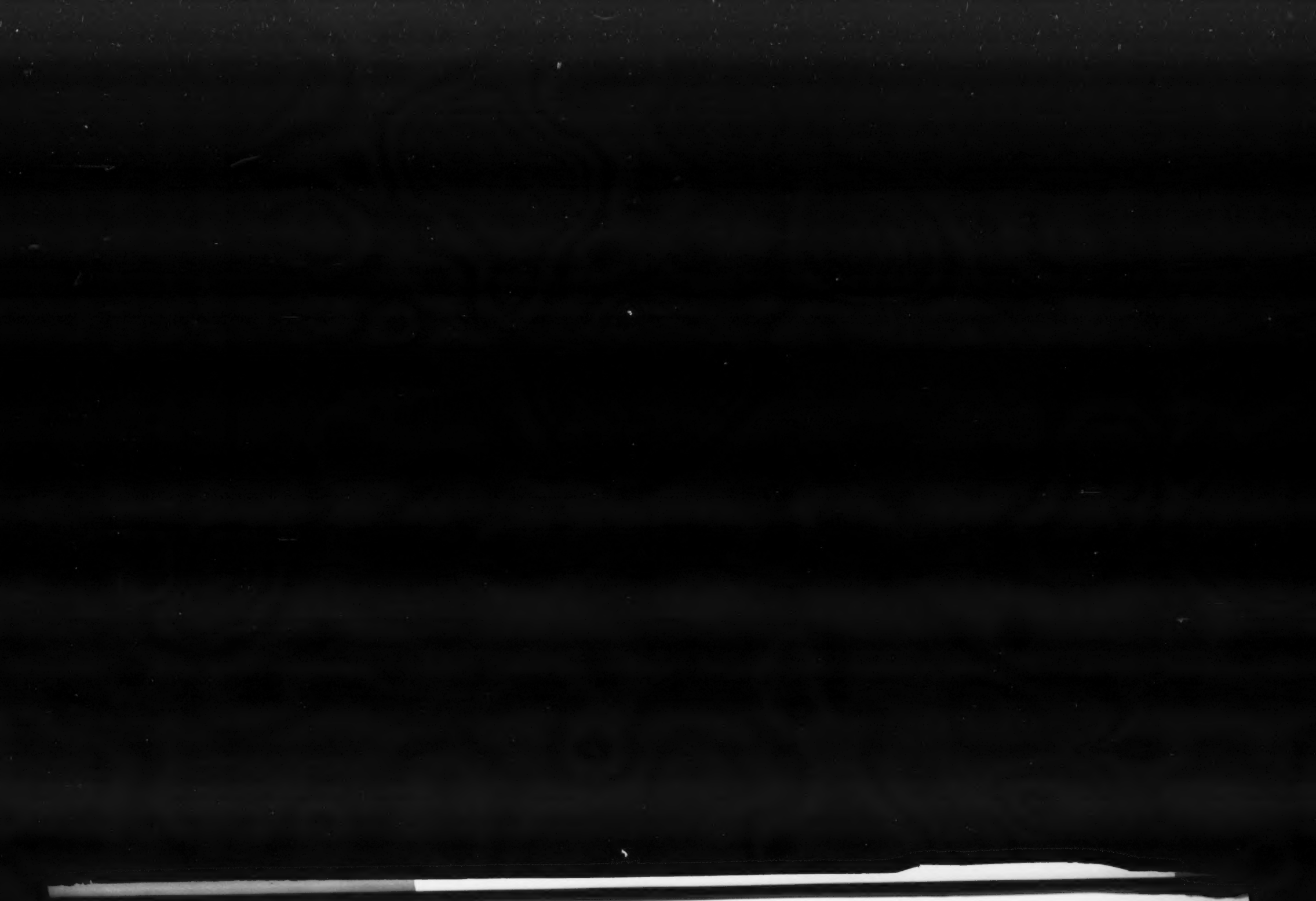
MADE and GUARANTEED BY THE
***Specialists in* Automatic Coal FIRING, HANDLING and CONTROL Equipment and CANTON INCINERATORS**

CANTON STOKER CORP. CANTON STOKERS

425 ANDREW PL., CANTON, OHIO
PHONE GLendale 3-9133

LOOKING FOR INDUSTRIAL SITES?

Let "Nick Plate" send you our detailed and accurate "Along the Line" surveys covering natural and agricultural resources, utilities, labor and other pertinent data relating to each specific location. Just tell us the area or type of location you are interested in. Call or write:

H. H. Hampton
NICKEL PLATE ROAD
1405 Terminal Tower
Cleveland 1, Ohio
Phone: MAin 1-9000

75 YEARS OF SERVICE 1881-1956
NICKEL PLATE ROAD